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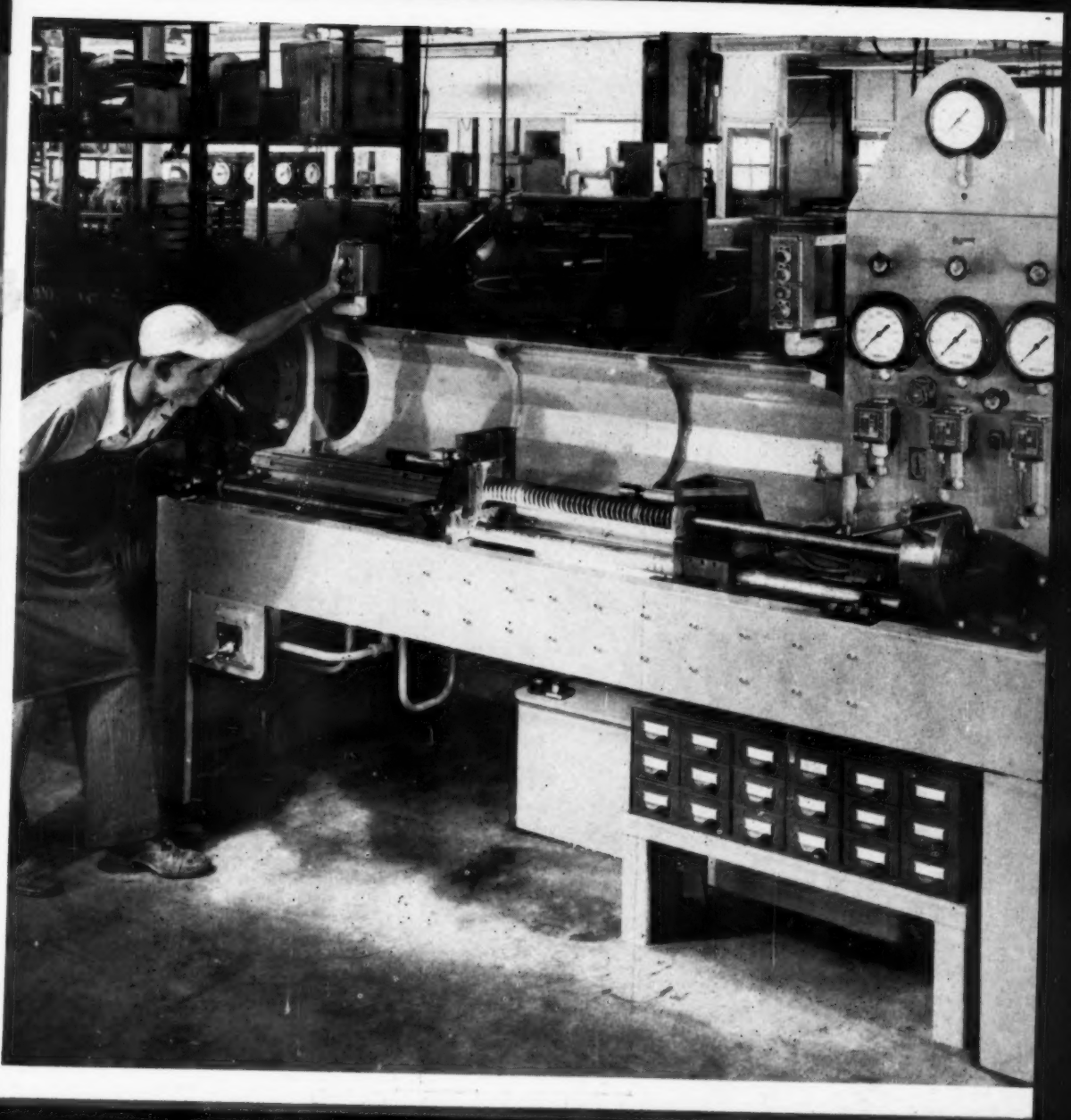
APPLIED HYDRAULICS

THE MAGAZINE OF FLUID POWER TRANSMISSION

CTOBER, 1949



- YDRAULIC CIRCUITS
- YDRAULIC CONTROLS
- R CIRCUITS
- R CONTROLS
- LECTRICAL AND LECTRONIC ONTROLS

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Aeroquip

RAILROADS

ENGINES

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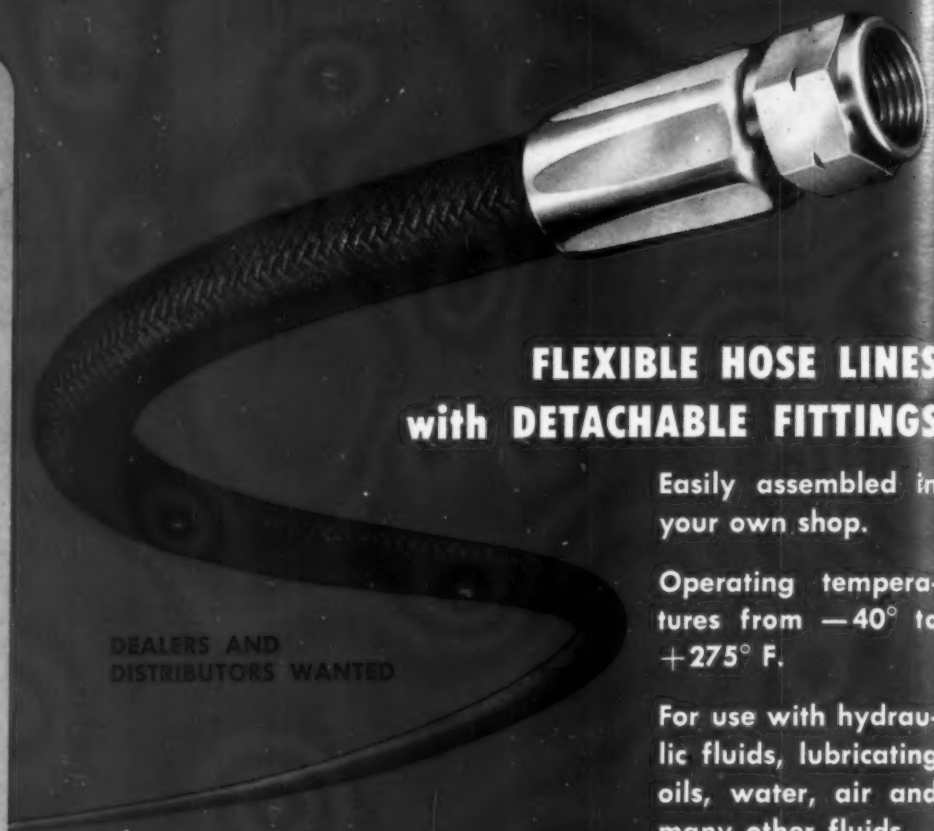

FLEXIBLE HOSE LINES with DETACHABLE FITTINGS

Easily assembled in your own shop.

Operating temperatures from —40° to +275° F.

For use with hydraulic fluids, lubricating oils, water, air and many other fluids.

DEALERS AND DISTRIBUTORS WANTED

SELF-SEALING COUPLINGS

Allow separation and reconnection of fluid-carrying lines without loss of fluids or inclusion of air. 1 coupling takes the place of 2 hand-operated valves.

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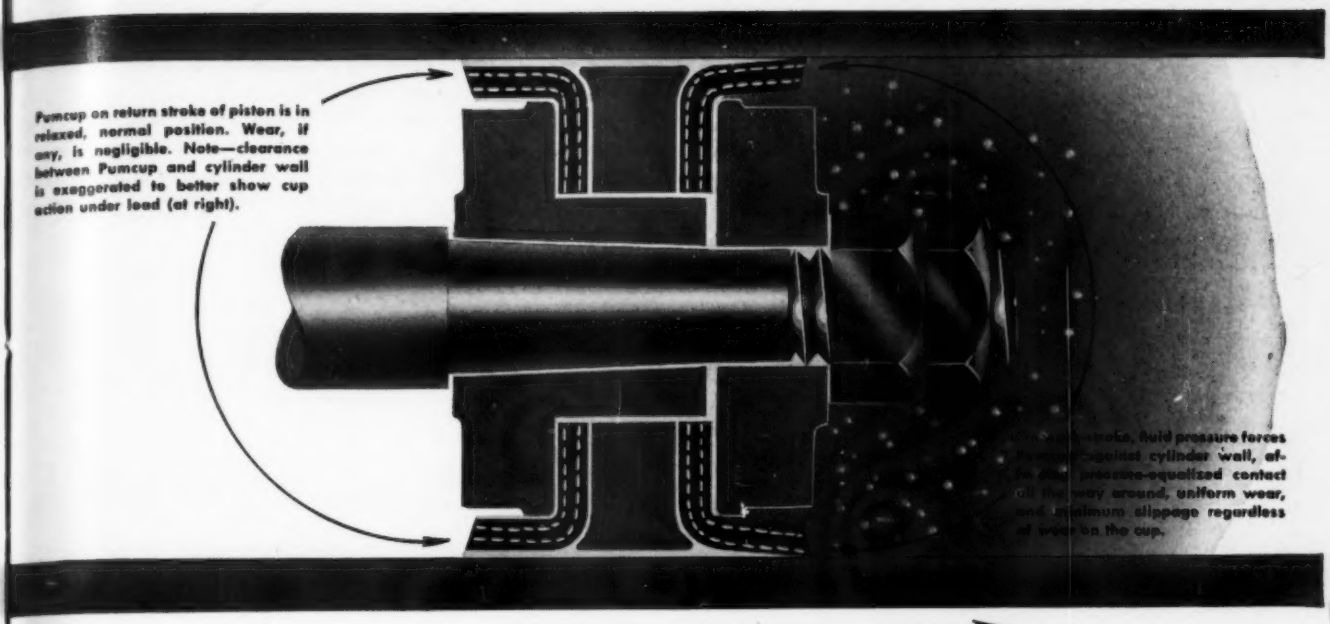
AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U. S. A. AND ABROAD


Pumcup on return stroke of piston is in relaxed, normal position. Wear, if any, is negligible. Note—clearance between Pumcup and cylinder wall is exaggerated to better show cup action under load (at right).

PUMP PISTON MOTION

NEW RETIREMENT PLAN . . .

for piston packing

WHAT is the "retirement age" of the piston packing in your reciprocating pumps, or in your air or hydraulic controls? A day? A week? A month?

Think what you could save in maintenance expense, in costly shutdowns, with a packing that does a perfect job 5, 10, or even 100 times as long. That's exactly what Darcova Pumcups are doing in thousands of installations where they have replaced leather crimps, ring packing, metal or plastic rings, or other ordinary packing.

How? First, the drawing above shows how the cup principle, scientifically applied the Darcova way, minimizes friction, equalizes and retards wear. Second, Pumcups are made of a special, Darcova-developed composition, exceptionally wear-resistant and immune to tough pressure and temperature conditions. Third, Pumcups are precision-built in many different textures, each absolutely uniform. Fourth, despite wear, high volumetric efficiency is retained for the life of the packing.

So, if you're not using Darcova Pumcups, you're in line for a new piston packing "retirement plan"—one that will save you plenty of time, trouble and expense. For a free bulletin containing complete information, write, or use the coupon below.

Darcova Pumcups are made in standard sizes from ½ to 42 inches in diameter, are easily installed in any reciprocating pump or air or hydraulic mechanism to replace ordinary packing. They handle virtually any fluid under a wide range of pressure and temperature conditions.

DARCOVA

THE ORIGINAL COMPOSITION CUP

DARLING VALVE & Manufacturing Co.

WILLIAMSPORT, PA.

Darling Valve & Mfg. Co., Williamsport 15, Pa.

Please send me the free bulletin checked below:

☐ No. 4401 Darcova Pumcups for reciprocating pumps.

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APPLIED
HYDRAULICS
The Magazine of Fluid Power Transmission

FRONT COVER: An operator starting the cycle of the hydraulic spring pressing machine designed and built by the Apparatus Division, Hunter Spring Company. The machine in use in this company's shop handles wire sizes in ⅛ in to ⅝ in maximum diameter at a cost saving from 25 cents to 1 dollar per thousand.

Photo courtesy, Hunter Spring Company

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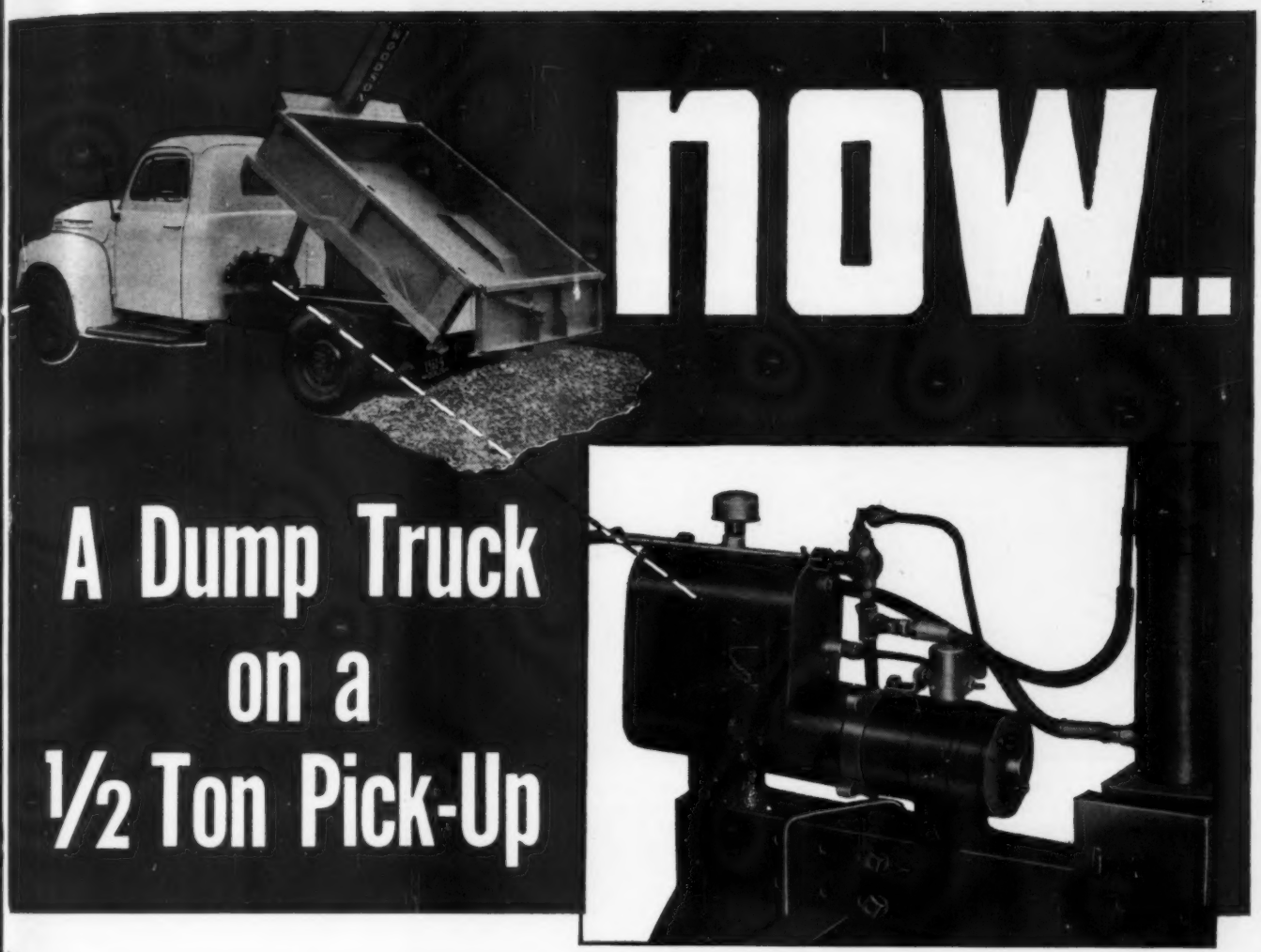

This Pesco Power Package Makes It Possible!

Woodson Products, Detroit manufacturer of specialized truck bodies, realized the need for a light dump truck. For farmers, coal dealers, contractors and light haulers it would prove a real time and money saver. But how to lift the dump body was the stopper. Light trucks have no power take-off. Therefore, the unit would have to supply its own. What's more, it would have to be light, compact, inexpensive to operate, foolproof to use.

Woodson found the answer in the Pesco electric motor-driven Power Package Compact, its motor, hydraulic pump, reservoir, check and relief valves are built into a single unit. Powered with a battery-operated, 6-volt, d.c. motor, it will raise a 1-TON load in 40 seconds, using only 85 amps—1/100 of the battery's capacity. It is available in ½-ton to 2-ton capacity.

It is push-button controlled and it will raise, lower or hold the dump body in any position. And Pesco's exclusive "Pressure Loading" feature assures the highest operating efficiency, at all times.

Fully proved in use. During the war, thousands of Pesco Power Packages raised and lowered the landing gears of thousands of bombers, where absolute, trouble-free dependability was a *must!*

Whether you make dump trucks or farm machines, hydraulic presses or machine tools, Pesco Power Packages, Hydraulic Pumps, Motors or Control Valves will help you get more efficient operation, more positive control, easier sales. Write today for more information.

★ **DESIGN ENGINEERS:** Pesco Power Packages are available for 6, 12, 24 and 33-volt, d.c. systems. With a capacity range from .7 gpm to 4.5 gpm, at 1000 p.s.i.

Pesco PRODUCTS DIVISION
BORG-WARNER CORPORATION
11610 Euclid Ave. - Cleveland 6, Ohio

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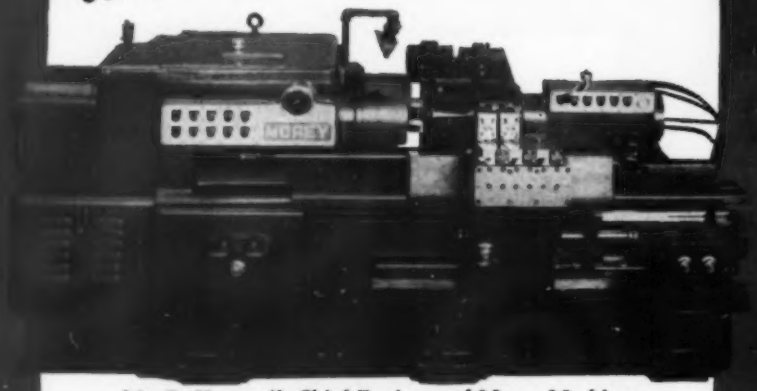
GREER
ACCUMULATORS
ELIMINATE PUMP AND VALVE...
MAINTAIN CONSTANT PRESSURE...
SAVE 10% OF MACHINING TIME



Mr. R. Kurzweil, Chief Engineer of Morey Machinery Co. Inc. writes: "Two types of Greer Accumulators are used on our Model DB Lathe shown above. Two A1 M are used in one part of the circuit for maintaining pressure in one part of the system regardless of any pressure drop in the rest of the system. To accomplish this without the accumulators, an additional pumping unit and related valves and manifolds would be needed. This would make the equipment substantially more expensive. The second type accumulator, A5 H, is used as a volume storage chamber to increase the speed of rapid traverse on all slides. The accumulator reduces idle time by 5 to 10 seconds amounting to about 10% of machining time."

Our thanks to Mr. Kurzweil and numerous other satisfied customers in all phases of industrial hydraulic application who have discovered new standards of economy and efficiency through the Greer Accumulator.

If you have hydraulic actuated equipment it will pay you to investigate how a Greer Accumulator can benefit you.

If you have hydraulic actuated equipment it will pay you to investigate how a Greer Accumulator can benefit you. Write for details today.

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454 EIGHTEENTH ST., BROOKLYN 15, N. Y.

LETTERS to the Editor

How about a "How to Do It" column or corner for APPLIED HYDRAULICS? There are a lot of small problems that could be discussed that would be very helpful.

T.M.

Fine, send along your problem and we will make a start on it. The idea is one we have played with but haven't got around to. We invite other contributions. We will do our part in getting some good answers for each problem sent in.

The following two problems have been sent to us, and, while we have made suggestions, we welcome answers from our readers. We will promptly forward such answers or solutions to our inquirers.

Can you suggest an automatic device to deliver an air blast at end or between strokes of a very small one-inch stroke, high speed power press, driven by motor from light socket. The device must be compact for attaching to press and there is no source of power available other than 110 v light circuit and the press.

W.C.C.

Can you give us some information as to what size cylinder we would require for the following job: We want to broach a square ¾ in from a 25/32 original hole. The length of the broach will be 1¾ in, the material to be broached is 1040 steel. The broach operation is now done by mechanical means in five steps: 6.75, 7.10, 7.30, 7.40 and 7.50. These steps will be done one at a time and one hydraulic cylinder could do the job. Would you advise me what size hydraulic cylinder to use, what pressure to use and what size pump you would recommend for this operation?

M.M.D.

Some months ago you sent us a list of books and manuals on hydraulics which we have used to purchase several and to secure others from manufacturers. We would like to set up a systematic service and maintenance reminder system for several of our departments where hydraulic equipment is growing in number. Where can we get the data or help to set up such a system?

G.K.

We have two or three suggestions: several of the major hydraulic oil suppliers have gathered data from which they can give you definite help in such a program; five or six of the hydraulic component manufacturers have issued manuals (we have run such data in the Maintenance Section

(Continued on page 10)

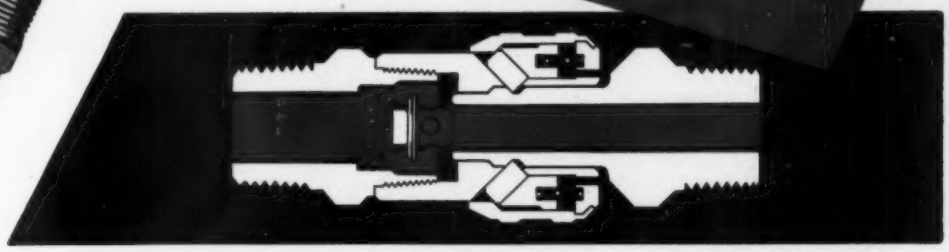
HANSEN

QUICK CONNECTIVE SHUT-OFF COUPLINGS

HYDRAULIC • PNEUMATIC

HANSEN PUSH-TITE COUPLING

Cross-section at upper right shows flow through coupling when connected.

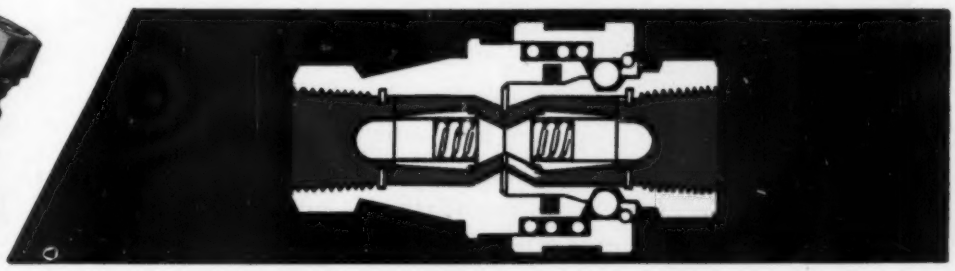


HANSEN *PUSH*-TITE COUPLING *Shuts off one side of line*

Hansen Push-Tite Couplings give you quick connection and disconnection, with instant automatic flow or shut-off. To connect coupling, and open line to flow of fluid, you merely push plug into socket. To disconnect, a slight pull on sleeve releases plug and shuts off supply end of line. Free swiveling plug prevents hose kinks.

HANSEN SERIES HP 8000

Shuts off both ends of line when disconnected.



HANSEN *HIGH-PRESSURE 2-WAY Shut-off* COUPLING

To connect, merely pull back sleeve and push plug into socket. Identical torpedo type valves permit free flow of gas or liquid through coupling. To disconnect, just pull back sleeve—coupling immediately disconnects, valves automatically and instantly seal both ends of line. Can be mounted to disconnect automatically where fluid lines may be subject to sudden, damaging strain.

WRITE FOR CATALOG No. 47

giving descriptions and sizes of complete Hansen line of straight through and shut-off couplings for hydraulic and pneumatic connections.

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New England States: Pearse-Pearson Co., West Hartford, Connecticut, Boston, Massachusetts

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Arizona, S. California: Chester Paul Co., Glendale, California

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IN CANADA

Province of Ontario: John Best Associates, Toronto, Ontario

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QUICK CONNECTIVE FLUID LINE COUPLINGS

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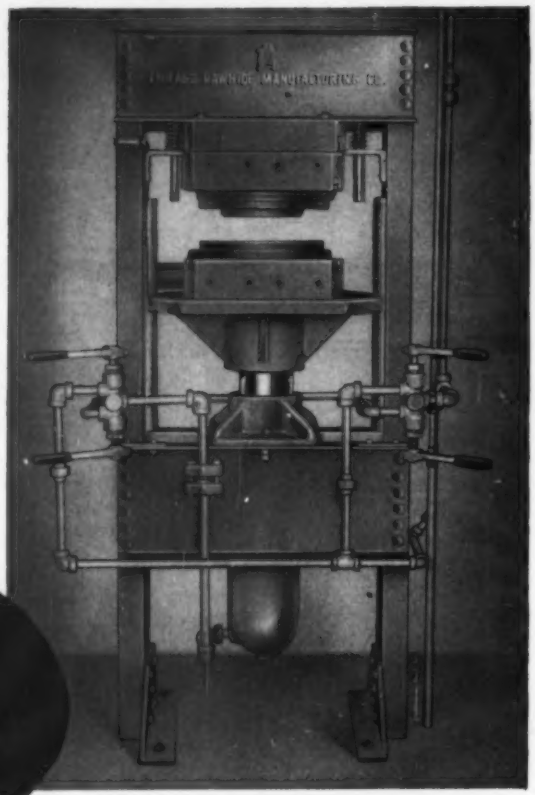
IN REPLACING HYDRAULIC PACKINGS

SAVE TIME and MONEY



specify sirvis

Replacing the "U" ram packing on a hydraulic press is an expensive procedure. Usually it involves dismantling the press, and the cost of installation is much greater than the cost of the packing itself. So, it's sound practice to use the best packing available. Actual tests prove that Sirvis "U" type packings deliver maximum service. On the hydraulic press illustrated, a Sirvis leather packing functions as the pressure sealing unit. Despite the extreme pressures and the action of hydraulic fluid in this application, the Sirvis packing requires less replacement than any other type. Sirvis will solve your packing problems with similar economy and service. The next time you install or replace hydraulic packings, specify Sirvis.

• *SIRVIS PACKINGS are engineered from top grade steerhide, specially tanned and treated. They are scientifically designed for all types of mechanical applications.*

MECHANICAL LEATHER PRODUCTS

sirvis

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(Continued from page 6)

of this publication) that have point-by-point procedures to follow; a number of the machine tool manufacturers have issued operators manuals and maintenance and service booklets in which excellent procedures are to be found.

Our editorial mail has been heavy with requests for names and locations of schools and industrial organizations which maintain training programs on hydraulics and its related problems. Excerpts from a few such letters and our replies may be of interest to many others who have the same interests or problems.

We have been handling several lines of hydraulic and air equipment but have been calling in a control man for many of our hookups. We would like to do more of our own control work and eventually do all of it. We would consider it important enough to shake loose one of our younger engineers long enough to attend a short training school in controls or simple instrumentation. Can you offer any suggestions?

J.P.

Several of the leading manufacturers of control equipment offer training schools, clinics or short training programs. One of these is the Brown Instrument Division, Minneapolis-Honeywell Regulator Company, who offer one and two week courses in instrument maintenance and repair. Full information will be received by writing Training Department, Brown Instrument Division, Minneapolis-Honeywell Regulator Co., Wayne and Roberts Ave., Philadelphia 44, Pa. Also consult with the sales representatives of the firms from which you are now buying your control equipment.

We are a farm equipment dealer and the volume of hydraulic machines we sell is steadily increasing. We do practically all of our mechanical maintenance and service work but are often in hot water on hydraulic system breakdowns. Our customers rightly expect us to fix almost anything that goes wrong. How can we right ourselves in the shortest possible time?

B.F.

At least four of the leading manufacturers of hydraulically actuated farm equipment maintain training courses for their dealers. Whether the line you handle is one of these or not, write to your supplying company. The chances are good that they have facilities at their plant, as a part of a regular training program or not, where you or one of your maintenance men could quickly learn the essentials you need to "fix almost anything".

Do you publish an index to the editorial material pun in APPLIED HYDRAULICS? May I have a copy if you do?

H.G.B.

Yes we do; a copy of the index to the first year's editorial material has been sent you. A limited number is still available for distribution.

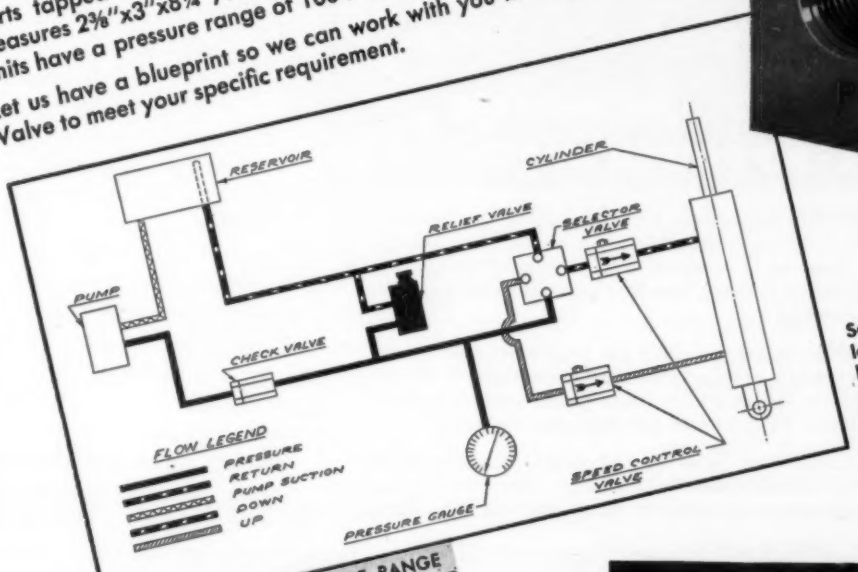
NOW—A Hydraulic Relief Valve that Does Not Squeal or Chatter!

The Electrol Relief Valve Has a Dampening Device to Assure Quiet... Efficient Performance!

Here, at last, is a Hydraulic Relief Valve that will help you put more quiet into your product! It is the new Electrol Hydraulic Relief Valve—equipped with a built-in Dampening Device that smothers squeal or chatter. Designed for use in oil pressure systems, the Valve has a cracking pressure up to 90% of the full flow, with a re-seating pressure that can be held as high as 85% of the full flow.

Available in two types: The Model #523-8 measures 1⅜"x2"x5", has ports tapped ⅜"—18 NPT, and passes 6 GPM; the Model #523-14 measures 2⅜"x3"x8¼", has ¾"—14 NPT ports and passes 16 GPM. Both units have a pressure range of 100 to 2100 PSI.

Let us have a blueprint so we can work with you in adapting this Relief Valve to meet your specific requirement.



Schematic drawing, at left, shows typical installation of Electrol Relief Valve being used to by-pass excessive fluid pressure.

MODEL #				PRESSURE RANGE
(⅜" NPT)	523-8-1	(¾" NPT)	523-14-1	100-400
	523-8-2		523-14-2	200-800
	523-8-3		523-14-3	300-1200
	523-8-4		523-14-4	400-1600
	523-8-5		523-14-5	500-2100

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Miller
Air Cylinders
Hydraulic Cylinders
SOLID STEEL HEADS, CAPS, AND MOUNTINGS — MACHINED FROM SOLID BAR STOCK
HARD CHROME PLATED PISTON RODS
DIRT WIPER SEALS
No Broken Castings
No Scratch-Damage
to Piston Rods, Bushings
and Seals . . .
therefore . . .
NO COSTLY "DOWNTIME" - NO REPAIRS
NO MAINTENANCE - NO POWER WASTAGE

SOLID STEEL HEADS, CAPS, MOUNTINGS. Dependable protection against the breakage that commonly occurs in "cast" cylinders when subjected to heavy shock loads in normal operation and when subjected to eccentric loads developed by cylinder misalignment. Eliminate "porosity" of castings. *Standard construction on all Miller Air Cylinders and Hydraulic Cylinders.*

HARD CHROME PLATED PISTON RODS. 90,000 to 110,000 psi yield point heat treated stress relieved steel accurately ground, polished, then *hard chrome plated.* Highly resistant to the nicks and scratches that commonly cause power wasting leakage. *Standard construction on all Miller Air Cylinders and Hydraulic Cylinders.*

DIRT WIPER SEALS. Wipe piston rods clean on every "in" stroke, protecting piston rods, seals, and bushings from scratch-damage by dirt, scum, abrasive particles. Easily replaceable. *Standard construction on all Miller Air Cylinders and Hydraulic Cylinders.*

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- AIR CYLINDERS 1½" to 20" Bores
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- HIGH PRESSURE HYDRAULIC CYLINDERS 1½" to 12" Bores

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write for

Miller Air Cylinder Bulletin A-105 and Miller Hydraulic Cylinder Bulletin H-104

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ASTE Hold Hydraulics Symposium

THE DETROIT CHAPTER AMERICAN Society of Tool Engineers held a symposium on hydraulics at their regular monthly meeting on September 8 at Rackham Memorial Building. Three of the speakers—Robert Mitchell, James Robinson and Don Morrell, spoke on phases of the J.I.C. Hydraulic Standards for Industrial Equipment and Otto Mueller of Mueller Engineering Co. spoke on new developments in high pressure piercing equipment.

Mr. Mitchell, production engineer, General Motors, and executive secretary of the J.I.C. since its inception, reviewed the development of the standards through more than 20 conferences which began as a group meeting of General Motors master mechanics and ended as an industry wide effort to set up standards in the hydraulic field. Mr. Robinson, chief engineer of Vickers Incorporated, as chairman of the hydraulic sub-committee of the National Machine Tool Builders Association spoke on the interest and the support which the machine tool makers have given to the Standards and the amount of redesign which they have made in the interest of more accessible hydraulic elements and reduced maintenance.

Mr. Morrell, supervisor of Standards and Control Applications, Ford Motor Company, made a hit by showing pictures of older hydraulic machines, some of which were mazes of piping, inaccessible valves and unidentified elements and other pictures which showed the influence of the Standards in design for service and maintenance as well as efficiency and cleanness of circuits. He reviewed some of the advantages already apparent to the auto makers in specifying J.I.C. Standards for their hydraulically actuated and controlled machines.

Mr. Mueller, a specialist in high pressure piercing equipment, showed films of work being done on frames for a 1950 automobile. He predicted that hydraulic pressures would go much higher than the 3000-4000 psi now frequently employed.

The meeting was one of the largest ever held by the Detroit Chapter with over 300 at the dinner meeting and about 800 in attendance at the regular meeting.

Just one of the many applications for
ROCKWELL HYDRAULIC DRIVES

TO SUMP
TO MOTOR
FROM PUMP
FROM MOTOR
MOTOR
This Rockwell Rotocycle motor drives the paint mixer at 3600 rpm. Speed may be adjusted up or down by throttle control. When coupled to a Rockwell Hydro-Syn governor, motor units can be used to maintain constant speed, constant torque, constant pressure, volume or liquid level automatically.
PRIME MOVER
This Rockwell Rotocycle pump running at 1200 rpm will produce up to 6000 rpm motor speed. One central Rotocycle pump can be used to power a battery of drives.

NEW ROCKWELL-POWERED HOMOGENIZER MIXES PAINT WITH SPEED AND SAFETY

The new paint homogenizer pictured above is a development of Mead Cornell, 224 Natoma St., San Francisco 3, Calif. The rotating equipment is driven at 3600 rpm, by a Rockwell Rotocycle hydraulic system. It performs with absolute safety, since the volatile mixture is remotely located from the electric power source. This same hydraulic power can be used to drive vacuum pumps, compressors or actuating cylinders.

Due to the ability of the Rockwell hydraulic motor to maintain high torque during the acceleration cycle the time required for attaining operating speed is materially reduced—and without overload on the electrical circuit.

Rockwell has the answer to your particular problem either in hydraulic propulsion or pumping. Write today for engineering counsel on your proposed application or additional information.

Other **ENGINEERED APPLICATIONS of Rockwell Hydraulic drives include Centrifuges, Diffusers, Agitators, Extruders—in fact any service where variable speed flexibility with safety is required.**

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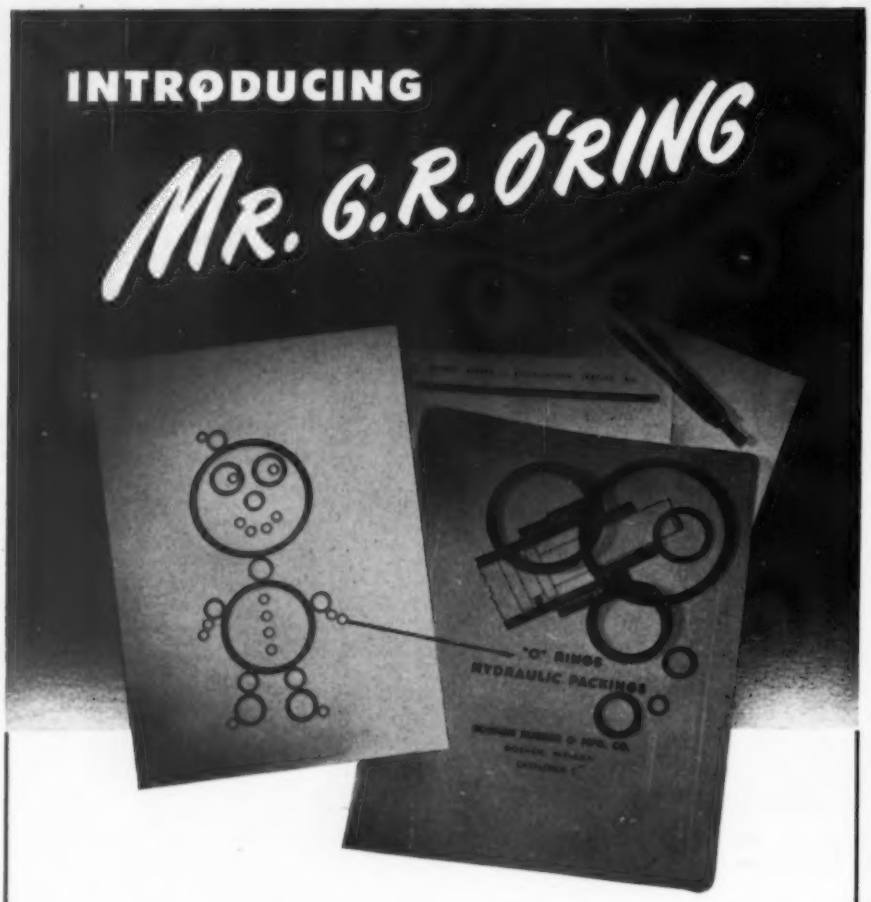

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With seven years specialized experience, he is fully informed on his subject, GRC "O" Ring Seals.

- In general reciprocating and static sealing applications to resist hydraulic fluids, anti-freeze solutions, refrigerants, ammonia, aromatic fuels, gases, oils and water "G. R." says your best bet is the GRC Commercial Hydraulic Grade "O" ring for economy, versatility and long service.
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National Metal Congress and Exposition

THE 31ST NATIONAL METAL CONgress and Exposition will be held the week of October 17-21 at Cleveland's Public Auditorium.

In addition to the American Society for Metals, the co-sponsoring technical societies — the American Welding Society, the American Institute of Mining and Metallurgical Engineers and the Society for Non-Destructive Testing, each will hold seminars, lecture sessions and meetings on technical subjects on metals production, treating and processing. A group of the country's leading engineers and research men will participate in the discussions.

An added feature will be the Round Table - Forum, which will hold eight sessions during the week. Such subjects as "Cost Cutting by Use of More Precise Castings or Formed Shapes", "Cost Cutting by Improved Heat Treatment Operations", "Economy in Production Through Improved Soldering and Welding of Sub-Assemblies" and similar discussions, all slanted toward the theme of the meeting, "Economy in Production" are on the agenda. Forum questions will be answered by leading specialists.

Another feature will be the continuous showing in the Economy Theater of films produced in the industry to show methods, products and equipment that have contributed to production savings.

ASM will hold their fourth Metallographic Exhibit concurrently; entries have been invited under a dozen different classifications.

Among the more than 300 exhibitors will be: American Brake Shoe Co., Anker-Holth Mfg. Co., Baldwin Locomotive Works, Cities Service Oil Co., Commercial Shearing & Stamping Co., Crane Packing Co., Fawick Airflex Co., Inc., General Electric Co., B. F. Goodrich Co., Gulf Oil Corporation, E. F. Houghton & Co., Lindberg Engineering Co., Ohio Seamless Tube Co., Raybestos-Manhattan, Inc., A. Schrader's Son, Shell Oil Co., Socony-Vacuum Oil Co., Inc., Sperry Products, Inc., Sun Oil Co., Superior Tube Co., the Texas Company, U. S. Hoffman Machinery Corp., Westinghouse Electric Corp. and Worthington Pump & Machinery Corp.

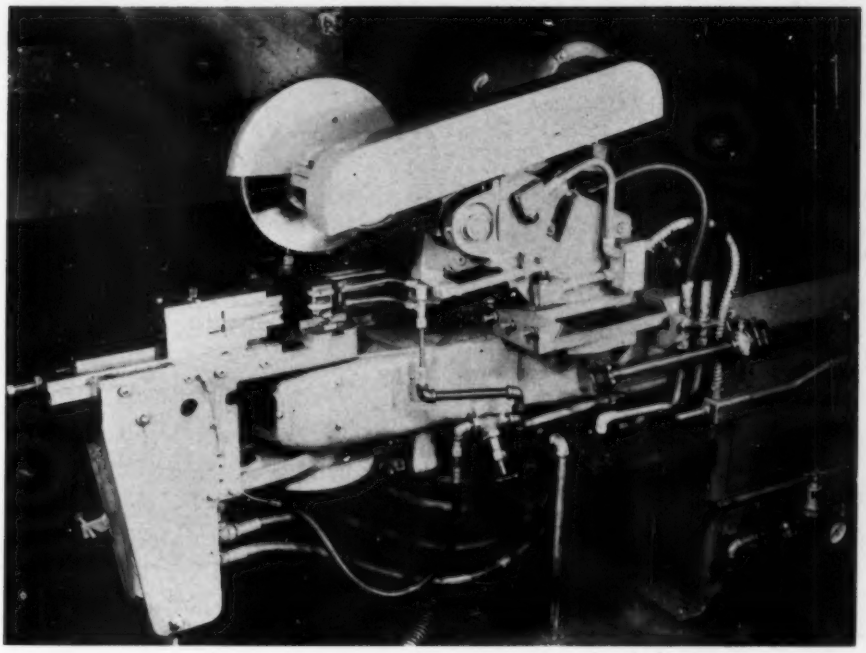

Fig. 1. The automatic cut-off machine, designed and built by Pines Engineering Co., Inc., Aurora, Ill. The machine is shown with the swinging arm rotated 90 degrees after the material has been cut and the clamp die retracted.

The Correlation of Hydraulic and Electric Control Circuits

This article, written at the special request of a number of readers, illustrates the importance of control circuits in reducing unit costs with a modern, automatic production machine. The hydraulic and electric circuits of a hydraulically operated cut-off machine are described in detail.

By DONALD E. GERBERICH
Electric and Hydraulic Engineer
Pines Engineering Co., Inc.
Aurora, Illinois

IN THE DESIGN OF ANY AUTOMATICally operated machine, the correlation of control circuits assumes an important part of the overall design, not only for the establishment of essential sequences of operation but also for continued, uninterrupted service under severe field conditions. Control circuits must perform perfectly if equipment designed to turn out improved products at increased production rates does its job. The hydraulic and electric control circuits of a new hydraulically operated cut-off bender will be described in some detail to illustrate the importance of their proper functioning in reducing production costs.

The cut-off machine, Figure 1, automatically feeds copper tubing, bends it and cuts off the bent piece, requiring the operator only to load the machine. Before describing the hydraulic and electric control circuits, it will be better to have a clear understanding of the operation of the machine and its bending cycle.

The bending tools consist of a bending die, a clamp die, a pressure die and a mandrel arranged as shown in Figure 2a. The bending die and clamp are mounted on the swinging arm, while the pressure die is mounted on the stationary arm. The mandrel is connected by the mandrel rod to the mandrel extractor cylinder mounted at the rear of

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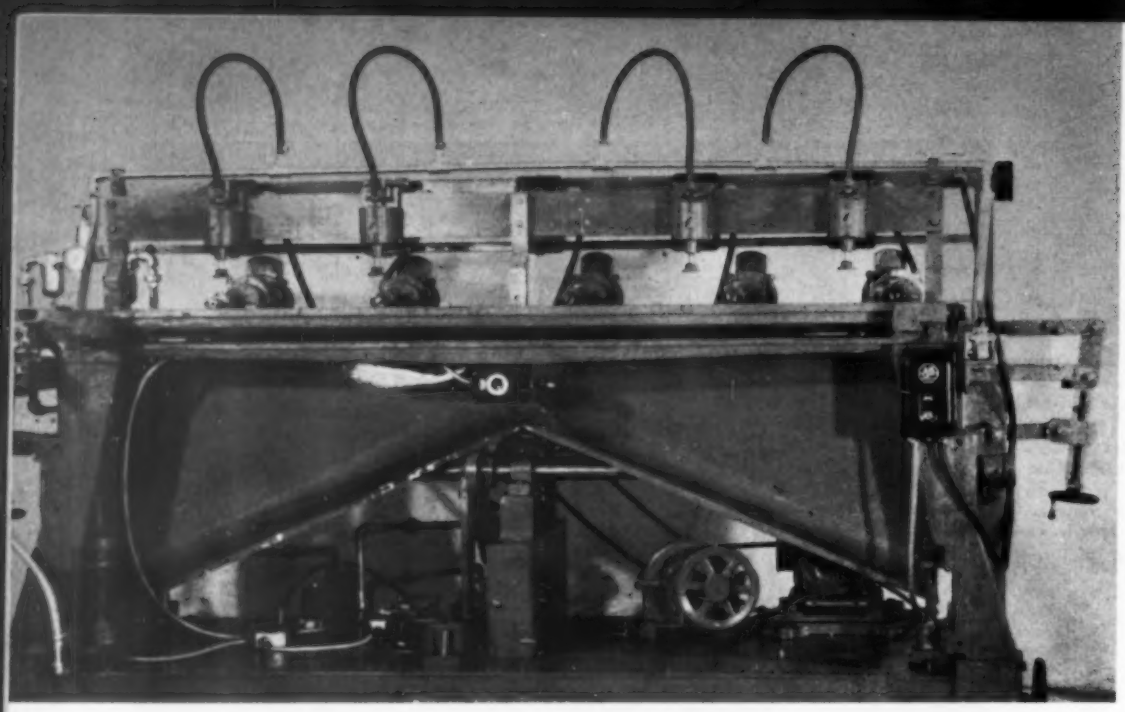


Fig. 1. Front view of the air-operated multiple mortiser showing five air turbine mortising motors, four air clamps, controls and the oscillating mechanism (right) and the airdraulic operating system (left) on the base shelf.

MORTISING

. . . 300 to 500 *PERCENT FASTER*

THE INDIANA FOUNDRY, MACHINE & SUPPLY COMPANY at Brazil, Indiana, builds wood working machines including mortisers. Mortising equipment tended to slow down production in the shops of manufacturers of chests and cabinets since the standard mortisers were able to work relatively short pieces and long rails had to be handled several times. The demand for increased production at lower cost made it imperative that this bottleneck be eliminated. The Indiana Type 188 multiple mortiser, described below, was designed and built to overcome this difficulty, common in fine furniture making shops, as well as in many other applications where several mortises are to be cut in one piece.

The most important change in the redesign of the mortising machine was the incorporation of an airdraulic cylinder, a combination of air power and hydraulic feed to utilize the entire 72 inches of length of the work table at one set-up and one handling of the stock. Tests indicated conclusively that the combination air and hydraulic cylinder was far superior to the straight air cylinder for feeding operations.

The table of the standard multiple mortiser is equipped with five or six air turbine type or electric mortising motors. Electric mortising motors might be substituted for air turbines for plants without sufficient air capacity to handle the air turbines. Bits for the mortising operation are mounted on chucks on the motors. The motors are mounted in eccentric rings to give minute adjustment for height. Each motor can be cut in or shut off by a cock or switch, giving a considerable flexibility of operation. The stock is carried to the bits by the work table; the feed movement is controlled by the solenoid-controlled airdraulic cylinder.

The feed cycle is initiated by depressing a push button, located conveniently on the front center of the machine. The solenoid is tripped by a contact as short as on-tenth second. The machine may be set for intermittent or continuous operation; the rate may be varied from 6 to 10 or more cycles per minute. At ten cycles, the maximum practical operating speed, the operator has ample time to handle the stock.

Up to five mortises may be handled on the machine with standard equipment, more with extra equipment. The mortising units are oscillated on the dovetail mounting rail by a double eccentric driving mechanism, powered by a 1½ hp motor through a speed reducer, the

mechanism oscillating from 100 to 140 times per minute. Through an ingenious arrangement of the two eccentric discs, two lengths of mortises may be cut simultaneously. In this way, the operator may have any number of motors cutting a short mortise, with the remainder on the long cut or idle.

By utilizing the two eccentric pull rods, two set-ups can be made on this machine at one time. Thus, two operators can work side by side for a double run.

Two oscillating pull bars, running the full length of the dovetail rail, operate the long and short strokes. Motors can be quickly and easily changed from one bar to the other by means of two clamp screws.

The speed of the airdraulic cylinder may be adjusted for hard or soft wood by a simple manipulation of the feed control needle in the center cover. On very hard woods, the mortising bits will be broken if the feed is too fast. The airdraulic table feed mechanism provides for changing the rate of travel of the table by as little as one-half cycle per minute which was not available on the former mechanical type feed. This permits the operator to secure and maintain maximum production.

In the conversion of the multiple mortiser, the use of the airdraulic cylinder eliminated a lot of complicated gears and linkages, materially reducing maintenance and downtime. The elimination of gears and excessive linkage in the table feed removes one of the basic causes of frequent maintenance. The mortiser manufacturer reports that calls from the customers for repairs are almost non-existent. In fact, insofar as maintenance and repairs are concerned, he states that a number of machines have been shipped and never heard from since.

Time Studies Prove Production Increase

Time studies made in plants where this machine has been installed has proven that an increase from 300 to 500 percent in production over former methods have been made consistently. Its facility of operation and feed eliminates operator guess work and reduces operator fatigue. The superintendent of a northern Indiana furniture factory stated, "with our Indiana mortiser, one man can now easily do the work of three." In another plant, where the operator was habitually behind on mortise stock, the manager reported that since the new multiple mortiser has been in operation the operator has been able to spend more than half of his time on sanding equipment.

The circuit design of the airdraulic circuit system is very simple. The diagram, Figure 3 and the detail of the system itself, Figure 2, show how easily the components of the system can be reached for service or maintenance.

The multiple mortiser is also equipped with four air-operated stock clamps which are adjustable along their own mounting rail and are automatically operated by a timing valve.

At maximum capacity each air motor requires about 18 cfm. The cylinder and the stock clamps together require about one cfm, computed at the maximum practical operating speed.

The basic problem of greater production at lower cost, common in all industries, can be met most successfully and directly by providing the producer, in this case a furniture manufacturer and his workmen, with a more efficient tool. The airdraulic cylinder for table feed and air motors for mortising provided the redesigned mortising machine with the operating advantages that resulted in reduced maintenance costs, less operator fatigue and marked increases in production.

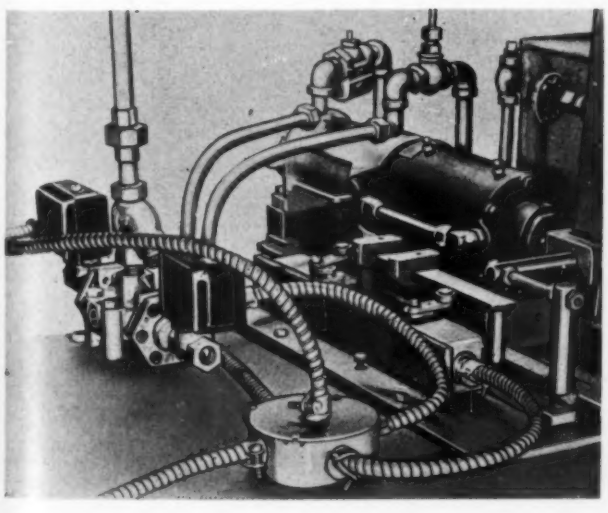
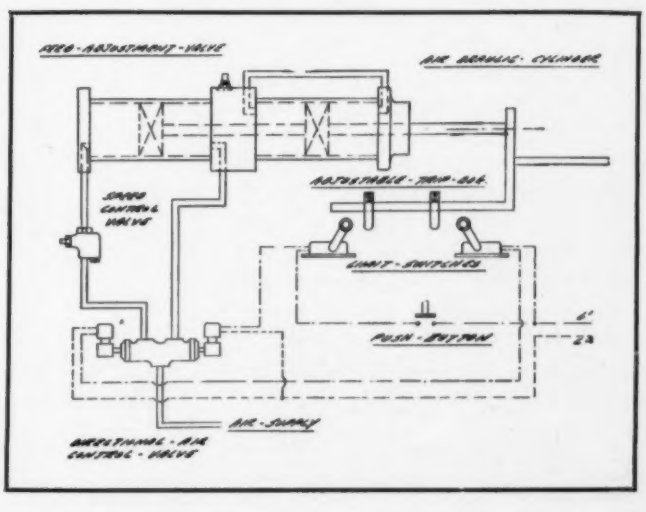


Fig. 2. The air power and hydraulic feed system. Components can be identified by reference to diagram Figure 3.

Fig. 3. Schematic diagram of the airdraulic system.



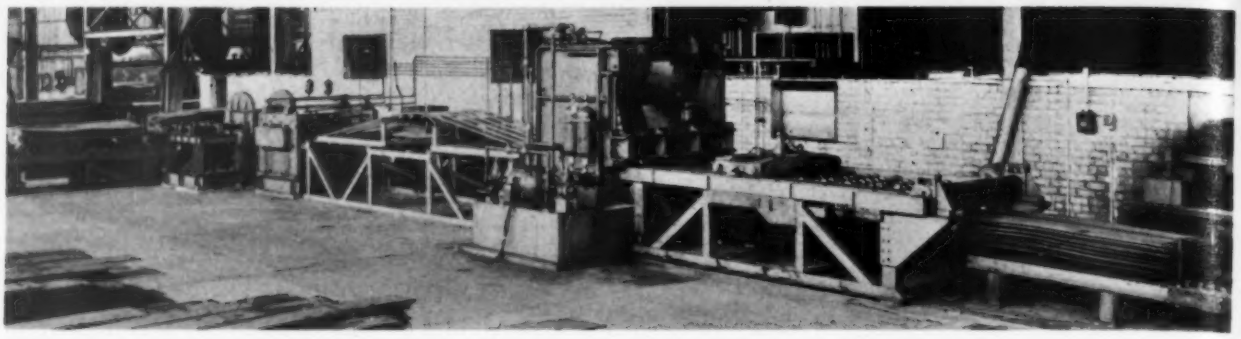


Fig. 1. A general view of the coil feed, leveler and shear line in the shop of Superior Sheet Steel Co., Louisville, Ohio.

ECONOMIES IN POWER FOR MACHINE TOOLS

By W. P. HALL

THE PROVISION OF MINIMUM YET adequate prime power units that function at a minimum of operating cost is a goal that machine designers continually strive for. Economies in power required to operate heavy equipment are practical with single or multiple installations of hydropneumatic accumulators. Not only is it possible to use smaller original power components for intermittent operations but the reduced power consumption is an important factor in cutting production costs. Three actual cases have been selected to show how the installations of accumulators have resulted in reducing costs.

A coil feed, leveler and shearing machine, Figure 1, designed and built by The Guide Company, Canfield, Ohio, and recently installed at the Superior Sheet Steel Co., Division of Borg-Warner Corporation, Louisville, Ohio, incorporates four accumulators in two of its circuits.

R. W. Bryan, chief engineer of the Guide Company, has pointed out that the inclusion of the accumulator in their shear machinery has allowed them to perform an extremely rapid cutting operation which would not have been possible with normal pumping operations.

From the schematic diagram, Figure 2, it is noted that two 1-gallon accumulators and two 5-gallon accumulators are used in the system. The one gallon accumulators are used on the threading and pinch rolls of the levelling unit, which is used to remove coil set and level the strip as it passes over the humping table into the shear. The advantages here are the elimination of a special

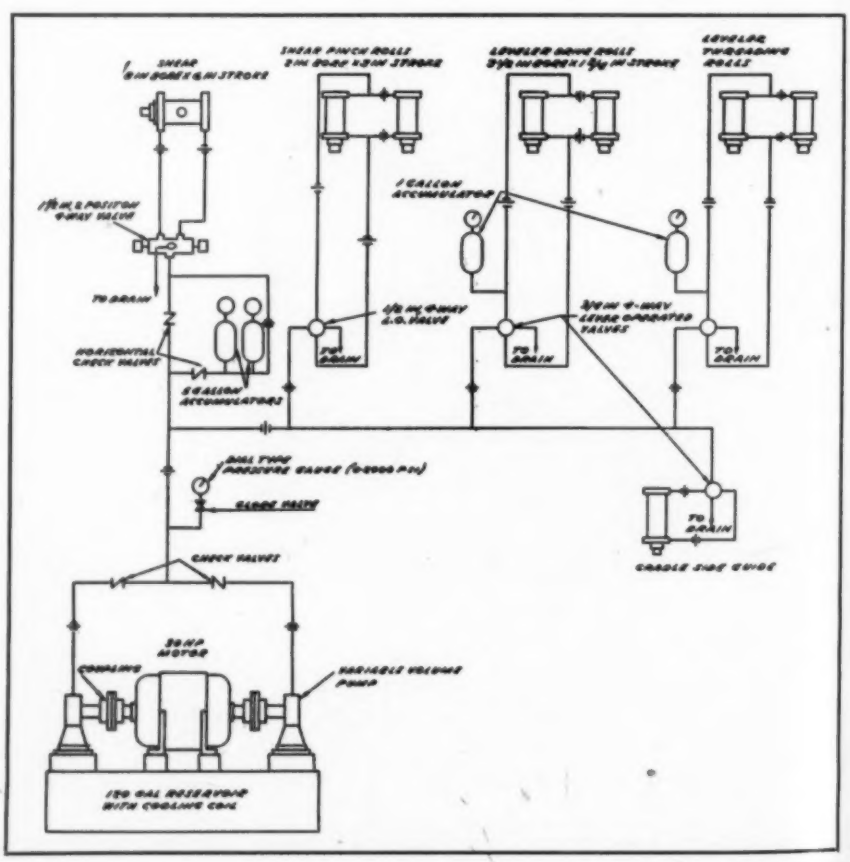


Fig. 2. Schematic diagram of hydraulic circuits in the coil feed, leveler and shear machine.

Case histories of the use of hydro-pneumatic accumulators to increase speed of operation, reduce power requirements and save space and operating costs.

pumping and valving circuit to perform the holding operation.

As the stock moves successively over the threading leveler drive and sheer pinch rolls to the shear, it is held by pairs of hydraulic cylinders. The threading and leveler drive roll cylinders are 3½ in bore x 1¾ in stroke, the pinch roll cylinders 2 in bore x 3 in stroke, all cylinders being standard rod, cushioned at blank end only. Lever operated ¾ in, 4-way, three position detent valves on the two leveler rolls in neutral maintain roll pressure and isolate the shear impulse from the leveler. The sheer pinch rolls are used only to convey butt ends into the shear after the leveler drive rolls have been passed.

A cradle side guide, which acts to square the sheet as it enters the threading rolls, is operated by a 4 in bore x 22 in stroke cylinder, a standard rod, non-cushioned type.

The two 5-gallon accumulators on the main shear circuit are used in parallel to provide fly wheel energy for the hydraulically-operated toggle squaring shear, in order to provide for as rapid a cut as possible. Mr. Bryan reports that if he depended entirely upon the pumps to stroke this cylinder, it would require approximately two seconds per stroke to shear the 56 in wide x .180 in maximum thickness material. Since the line speed is approximately 130 feet per minute, this would result in approximately four feet of material being looped each time that the shear made a stroke. Inasmuch as such a loop would cause sufficient bend in the material as to create a permanent set, and further, would result in extremely heavy impact of the sheet as it straightens upon release and cause a deviation in the gauging of length, such a time interval for the shear cut is prohibitive.

By the inclusion of the two 5-gallon accumulators, the shear is made sufficiently rapid as to cause only a small amount of excess material to loop on the humping table. While the operation has not been timed by stop watch, the cutting time has been accelerated to preclude possible trouble from deformation of the sheet due to humping.

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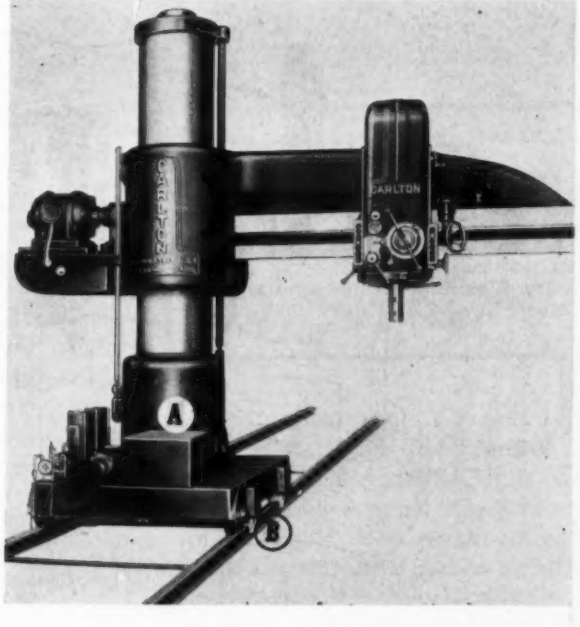


Fig. 3. The Carlton travelling base radial drill showing rail clamp shoes (B), and location of the hydraulic power pack (A).

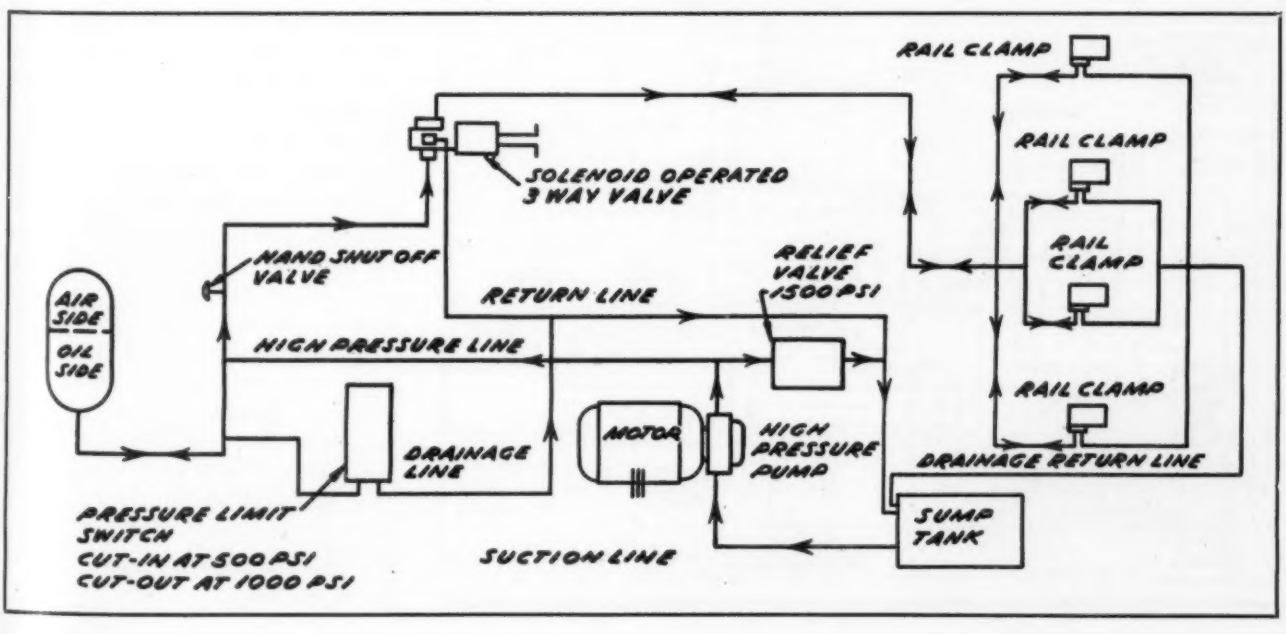
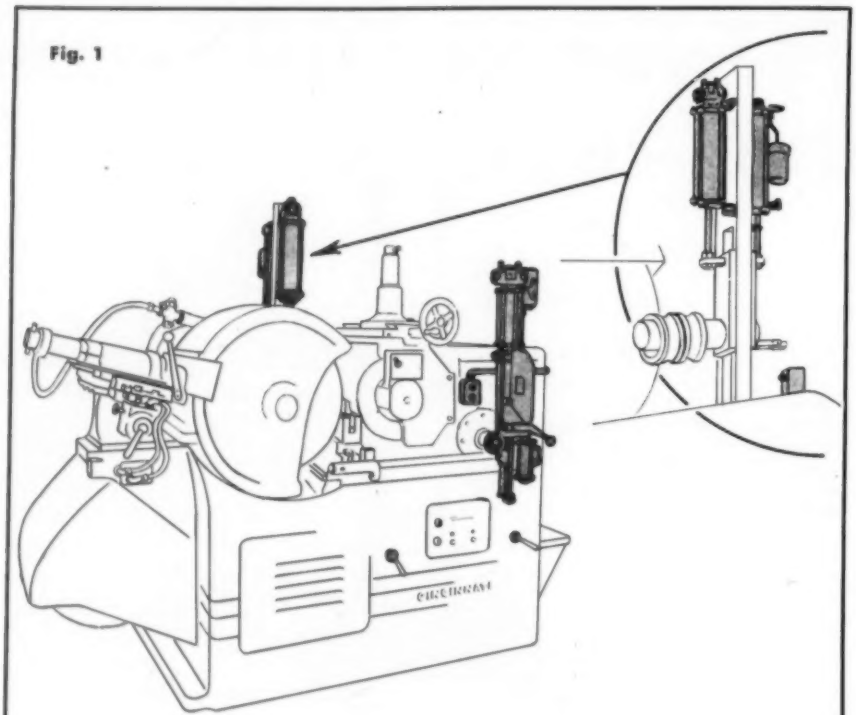


Fig. 4. Schematic of hydraulic system for travelling base rail clamping circuit.

Production Increased Over 300 Percent

THE PRODUCTION RATE OF ANY centerless grinding operation using the infeed method of form grinding is limited to a considerable extent by the time required for loading and unloading the machine. A Midwestern manufacturer, by incorporating the electrically-operated double acting cylinder or air motor with hydraulic feed control as illustrated, Figure 1, was able to increase the production on a form grinding operation on bearing flanges from 95 pieces per hour with many rejections to 310 pieces per hour with no rejections.

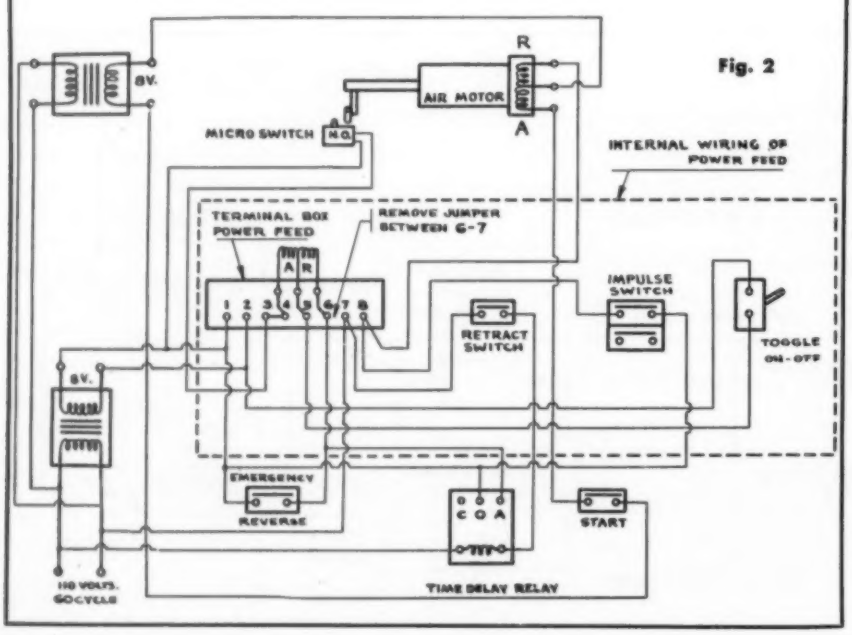
Fig. 1



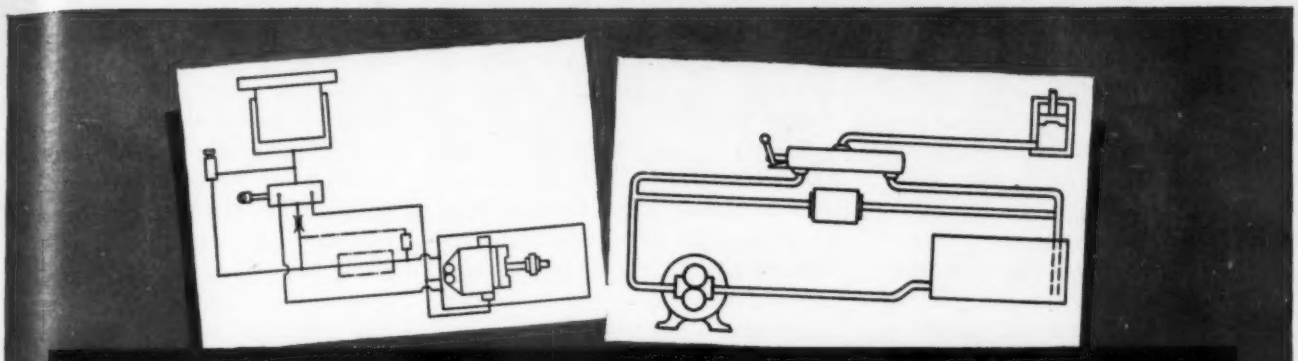
The added equipment made the No. 3 Cincinnati centerless grinding machine semi-automatic in operation. The setup for the bearing flange increased production well over 300 percent. Increases of 150 to 250 percent have been consistently made on many difficult jobs.

Figure 2 is a schematic wiring diagram of the air-hydraulic control equipment. To start the cycle, the operator depresses normally open contact push button switch, energizing advance solenoid on the air motor, advancing the piston rod and lowering the work into the machine. The speed of lowering the work into the machine is accurately controlled by an adjustable hydraulic resistance unit. The work is lowered until the one-way dog on the piston rod strikes and momentarily closes a normally open micro switch. This energizes the advance solenoid of the electric power feed, causing the feed to advance and move regulating wheel into the work. When the power feed has traveled a pre-determined distance, an internally located normally open retract switch in the power feed is closed, energizing coil in the pneumatic timed delay relay. The circuit closes when the pre-determined time interval has elapsed, energizing retract solenoid on the power feed. The power feed retracts, moving the regulating wheel away from the work.

Fig. 2



When the power feed reaches its fully retracted position, another internally located normally open switch in the power feed is closed, energizing the retract solenoid on the air motor which lifts the work from the machine. This completes the cycle and the machine is ready to be reloaded.



A Beginner's Course in Basic Hydraulics

Chapter III

PRESSURE GAUGES AND VOLUME METERS

Part 2

The principle of the disk piston for metering liquids; the operation and maintenance of the Niagara fluid meter.

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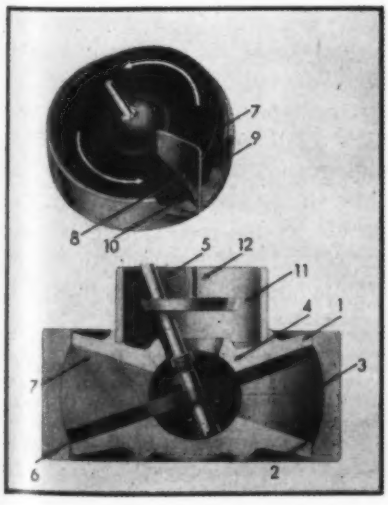
Volume Meters

WHEREVER LIQUIDS ARE CONsumed some method of checking intake against outgo must be provided. This is particularly true for diesel engine and boiler fuels, where the hourly quantitative record of fuel expenditure provides a check against the sounding of fuel-oil tanks and promotes engineering analysis and economy. Meters suitable for industrial use must be rugged, durable, accurate and suitable for prolonged use with little adjustment.



Any pump which displaces a uniform volume of liquid for each stroke of its piston could be used as a meter by installing a device for counting the piston strokes. However, for such a use, the pump would have to be designed to minimize leakage and guarantee uniform displacement.

Niagara meter. The Buffalo Meter Company manufactures a meter with a disk piston which acts on the principle most widely used for measuring liquids in moderate quantities. Meters of this type are available to measure flow up to 1000 gpm; however their use beyond 400 gpm is unusual. This range covers the bulk of industrial applications where an accurate meter is required.

Principle of the disk piston. In this type of meter the liquid passes through a fixed volume measuring chamber divided into upper and lower compartments by the disk. One or the other compartment is continually being filled while the other is being emptied. The pressure of the liquid as it passes through these compartments causes the disk to roll around in the chamber, in a manner to be described, and its movements operate a counter, through suitable gearing, to indicate the volume of liquid passed. The counter somewhat resembles the mileage indicator on an automobile, except that it usually reads in gallons.

The heart of the meter is the measuring chamber and disk piston. Figure 44 shows how the disk piston is located in the measuring chamber.

Fig. 44. Cross section of the measuring chamber and disk piston (below) and the dividing portion 7, in slot 8, with inlet opening 9 and outlet 10 (above) are shown.

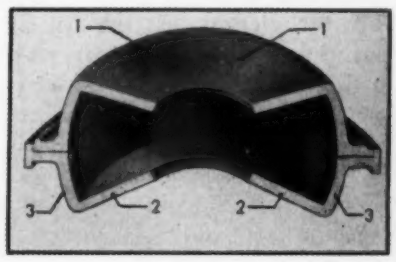


Fig. 45. Half of the measuring chamber showing conical side surfaces 1, 2, and spherical outside surface 3.

Half of the measuring chamber itself is shown in Figure 45. It is bounded at top and bottom by conical surfaces 1 and 2, which are joined at their outer edges by spherical surface 3. A view of the complete meter is shown in Figure 46.

Referring to Figure 44, the upper and lower surfaces of the chamber converge towards the center to form a spherical cavity for the ball 4, through which passes the spindle 5, which is connected with the counting gears, Figure 46. Disk 6 is attached to the ball; both disk and ball are machined to fit closely in the chamber. There is a slot 8 in the

Fig. 46. The cross section view of the Niagara meter shows the relation of the measuring or counting gears to the vertical shaft and wheel. The arrows indicate the line of flow of the liquid.

disk at one point, through which the thin partition 7 passes, cutting the chamber in two. There are openings in the outer wall of the chamber on each side of the partition; opening 9 is the liquid inlet, 10 is the outlet.

When the ball carrying the disk and the spindle is tilted as far as it can go, the bottom of the disk makes a close contact with the bottom conical surface of the chamber, while the top of the disk similarly contacts the upper conical surface at the opposite end of the disk. Since the disk is flat and the contacting surfaces are conical, contact takes place along a straight line on each surface. The lines of contact produce seals, which when taken in connection with the partition 7, divide the upper and lower compartments into two parts. The net effect is that the disk and partition produce four separate compartments in the measuring chamber, two above the disk and two below. The top and bottom compartments are separated from each other by the disk itself, while the pairs of compartments above and below the disk are separated by seal formed at line of contact between the disk and the conical top and bottom surfaces on the one hand, and by the partition on the other.

Spindle 5 rises from ball 4 and passes through wheel 11 at a point near its outside edge. Vertical shaft 12 is attached to wheel 11 and rotates with it. This shaft is connected at its upper end to the measuring gears, and is mounted directly over ball 4. When wheel 11 turns on its axis, the position of the shaft keeps the spindle inclined at just the angle to produce a continuous seal between disk 6 and the upper and lower surfaces of the measuring chamber.

The action of the meter can be understood by imagining wheel 11 to be revolved by means of shaft 12. The spindle would revolve with it, and would trace a conical path in space, as shown in Figure 47. This movement of the spindle would control the position of the disk. When the spindle was in position A, for example, the disk would also be in position A, while positions B and C for the spindle and disk would also correspond.

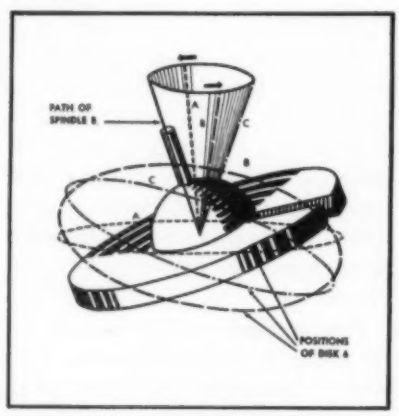


Fig. 47. The relation of spindle movement to position of the disk. The spindle revolves but since the disk cannot rotate, it wobbles up and down causing the seal lines formed by the disk edge to revolve around the chamber.

However, the disk cannot rotate, because partition 7 stands in slot 8. The disk therefore wobbles up and down, while the seal lines formed by the disk and the top and bottom walls of the measuring chamber are made to revolve around the chamber.

For the sake of simplicity, let us consider only the lower portion of the chamber. The seal will always be along the line which has the greatest inclination. As this seal line moves in the direction shown by the arrows in Figure 44, it will sweep the liquid before it and cause it to be discharged through the opening 10. At the same time it will be opening up an increasing volume in the compartment behind the moving line of the seal. Since this space is open to the inlet 9, it will be filled with fresh liquid. When the line of seal passes the partition 7, all the liquid formerly in front of the seal will have been forced out of the discharge. The seal line then starts to push the liquid which was behind it forward. The line of flow of the liquid is as shown in Figure 46.

Obviously, if the wheel 11 were continuously rotated, the disk 6 would move a volume of liquid equal to the volume of the lower half of the chamber, from the inlet to the outlet, for every revolution. While this was going on, the top section would be doing the same thing, except that its seal is always directly opposite the lower seal in the measuring chamber. Therefore, for every revolution, the piston will displace the volume of the whole chamber.

We have been discussing the meter as though it were a pump operated by the rotation of wheel 11. Actually, the case is just the reverse. The meter is operated by the slightly greater liquid pressure at the inlet as compared with the outlet. This pressure difference causes the seal line to advance around the measuring chamber, and in doing so rotates the wheel 11. This in turn revolves the indicating hands on the face of the meter by means of shaft 12 and suitable reduction gearing.

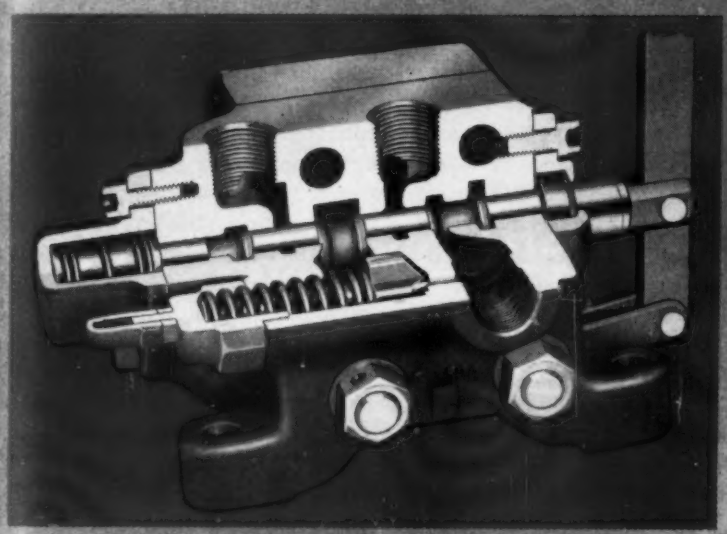
Standard meters are suitable for temperatures to 200 F, and for pressures to 150 psi, although models can be supplied for higher temperatures and pressures. The meters are accurate to about one percent or less.

To give accurate measurements a meter should be used only on the liquid for which was designed; the strainer should be cleaned periodically of all sediment and pipe scale; and air should not be allowed to pass through the meter. To keep air out, do not let the meter drain between periods of use, so that the pump stuffing boxes and suction will be kept tight.

Review questions for Chapter III are to be found on page 46. The November installment will begin a chapter on pipes, fittings and seals. Save each installment for reference.

"COMMERCIAL" HYDRAULIC OIL VALVES

SPACE 1738
THE METAL SHOW
CLEVELAND
PUBLIC AUDITORIUM
OCTOBER 17-21, 1949



Direct the Flow of Oil in Hydraulic Circuits Employing Pressures up to 1500 P. S. I.

FEATURES . . .

FULL PORTING AROUND SOLID SPOOLS—Unrestricted, non-throttled flow insures ample oil supply.

BALANCED SPOOL CONSTRUCTION—Sensitized finger tip control at all times against any pressure up to 1500 p. s. i.

HI-TENSILE NICKEL ALLOY IRON—Faces are surface ground—Bores are honed for perfect spool sealing.

ALLOY STEEL SPOOLS—Hardened, centerless ground satin smooth to extremely close tolerance.

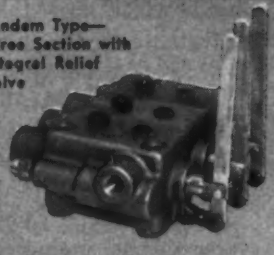
BUILT IN RELIEF VALVE—A safety feature for your entire hydraulic circuit which permits exact predetermined pressure setting for protection against overloading.

PRESSURIZED OIL SEALS—Long wearing, self adjusting, with metal encased element.

Any number, sequence or combination of sections having various control actions, all standardized and interchangeable, can be arranged in one assembly with Tandem Type Valves. Additional sections can be inserted into your present valve assembly to provide for control actions that may be required in the future. Spare replacement sections can quickly be inserted and are a good protection against damage which could shut down your equipment.

LOOK INSIDE—QUALITY IN EVERY DIRECTION

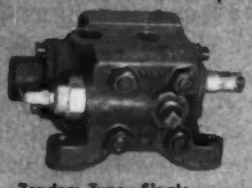
Tandem Type—Three Section with Integral Relief Valve



Unit Type—Single Section with Integral Relief Valve

Standard ½" Valves—Capacity up to 15 G.P.M. Single Acting or Double Acting

VALVE SPOOL OPERATING CHARACTERISTICS—Spring centered for automatic return to neutral position. Poppet located for positive selection of all positions.



Tandem Type—Single Section—Double Acting with Integral Relief Valve

Tandem Type—Seven Section. Single Acting—Double Acting—Float Sections with Integral Relief Valve

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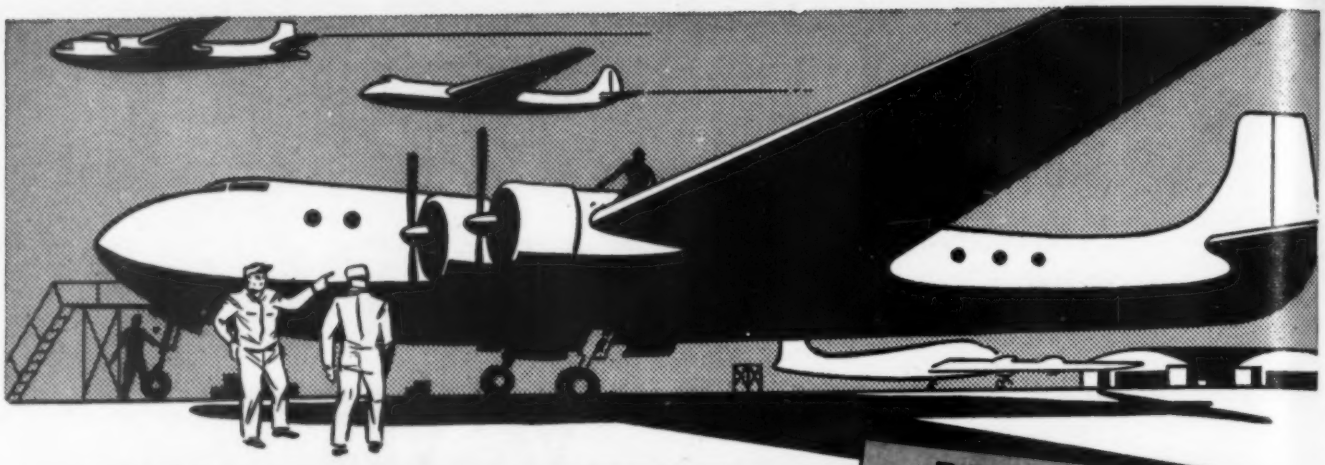


AVIATION HYDRAULICS

DESIGN
OPERATION
MAINTENANCE

FRED O. HOSTERMAN
Advisory Editor

Hydraulic Equipment on Modern Aircraft

MODERN TRENDS IN AIRCRAFT engineering continuously indicate that yesterday's miracles are the realization of today. The aircraft hydraulic industry is in step with these advances; many new developments are now either in or beyond the engineering stages.

The practical acceptance of 3000 psi operating pressures, for example, is a reality today. The majority of planes now being flown by commercial airlines use 3000 pound hydraulic equipment for many operations. Acceptance tests are now in progress for the military services; some pumps have been approved on a tentative Army-Navy specification for 3000 psi fixed displacement units. Work is also in process on variable displacement units.

Non-flammable fluids are now being concentrated on by the entire industry. While several successful fluids are being used to meet specific requirements, no fluid as yet can be considered the complete answer to all problems. When and if such a fluid is obtained, the manufacturers of hydraulic equipment will be faced with the problem of developing many component elements to suit such a fluid.

The drive of cabin superchargers on commercial aircraft is one of the many interesting postwar applications of hydraulic equipment. One type in common use is the split torque system, where a planetary gear train is used and one or two variable displacement hydraulic pumps provide oil flow to a hydraulic motor which varies the speed and the direction of the planetary gears, thereby controlling the output speed of the compressor. All of this equipment is built into a package unit, driven from a shaft from the aircraft power plant.

Another type completely eliminates the drive shaft by having the control and drive pumps mounted directly on the aircraft engine and the hydraulic motors mounted, through gearing, directly on the compressor.

Some of the original cabin supercharger drives were simply a direct mechanical shaft from the engine to the compressor. Several users of this type are testing a simple fixed speed hydraulic drive, which shows excellent promise.

(This is an abridgment of remarks made by James Robinson, chief engineer, Vickers Incorporated, in the panel discussion, "Getting the Best Out of Our New Transports", at the SAE Aeronautical and Air Transport Meeting, Hotel New Yorker, New York, April 12).

The use of a variable displacement pump with the proper controls would permit variable compressor speed in such a system. Properly designed, such a system can be made fully automatic.

Hydraulic applications in aircraft are no different from any other accessory installation. When marginal or low load design figures are the basis of design, the end equipment, when placed in service, may offer service difficulties. In order to increase the possibilities of a fully successful production system, design requirements should allow for the most severe operating conditions, plus an adequate safety margin. The end customer must decide which is more expensive—adequate, reliable installation at a weight cost of, say, 5 to 25 percent, or a marginal system comprising minimum weight at the cost of schedule reliability and unnecessary, high maintenance costs.

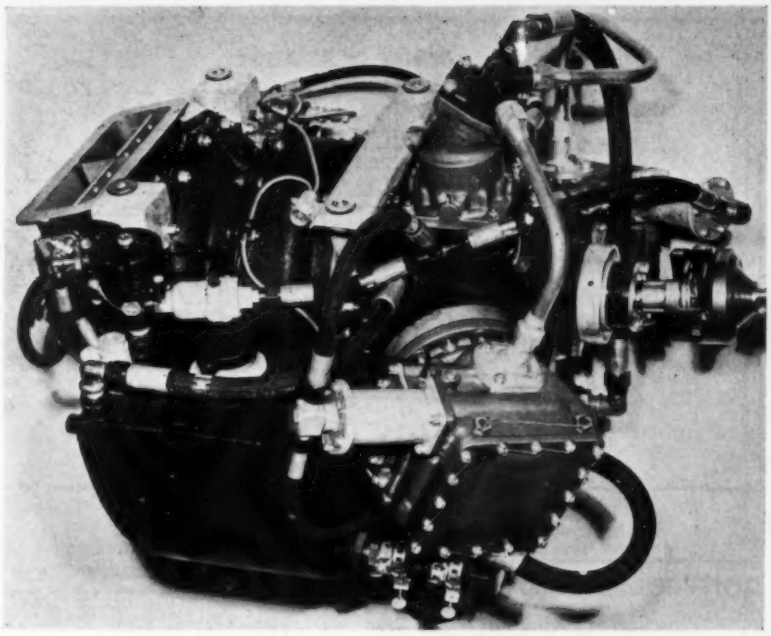
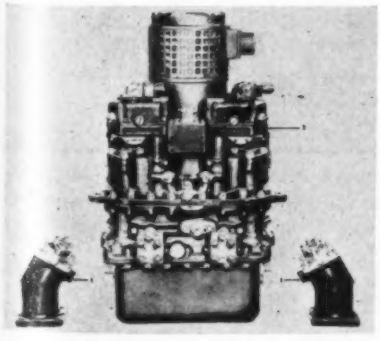


Fig. 1. A newly developed supercharger made for the Lockheed Constellation airplane.

Most manufacturers have found that their products have been affected by the impetus which the recent war gave to scientific and technical progress. Standards of performance have been challenged and raised to new standards, which in some cases are still in a state of flux and energetic re-investigation. For example, the use of various items of hydraulic equipment and their associated controls in high-performance servo circuits is of considerable interest and is continuing to attract more and more attention.

Numerous and varied combinations of pumps and hydraulic motors have been and are being employed in servo applications. Intensive studies in the servo field have provided the technical tool for greatly extending two important aspects of this work; a prediction of the performance of a group of individual units combined as a system; and a knowledge of how each individual unit should be designed in reference to the characteristics of the other units in the system.

Fig. 2. A typical wartime turret drive with a variable pump, hydraulic amplifier and fixed displacement hydraulic motor.



A specific application of these techniques is in the driving of aircraft turrets.

During the war the transmissions of several aircraft turrets were hydraulic. The basic equipment consisted of a variable pump, hydraulic amplifier and a fixed displacement hydraulic motor, all items mounted within a single housing.

The hydraulic amplifier consisted essentially of a small gear pump, whose output flow was ported through a follow-up valve to the stroking cylinder and piston. This piston was mechanically connected to a pintle-mounted yoke, which housed the cylinder block of a piston-type, main power pump. The hydraulic amplifier could tilt the cylinder block to any degree from zero to maximum on each side of neutral, and thus could change the direction of the output flow of the main pump to the hydraulic motor, varying the amount of flow in a smooth, stepless manner.

The follow-up valve was so named because its sleeve followed the spool to any position; the spool follow-up was obtained by mechanical linkage to the stroking piston or yoke. Therefore, the position of the spool was directly and lineally proportional to the angular position, or tilt, of the cylinder block. This gave a mechanical means of obtaining a rate, or velocity, feedback from the yoke or the valve. Thus, the turret velocity was determined by the position of the follow-up spool and automatically stabilized at a rate proportional to the spool position. This position, in turn, was controlled through an external controlling device actuated by the turret operator or gunner, through his hand control unit.

A revision undertaken for response improvement has resulted in the elimination of the mechanical feedback linkage from the pump to the control valve sleeve and the use of a three-way valve with a stationary sleeve, greatly reducing the total movement required from the solenoid and obtaining full displacement of the valve on a smaller percentage of maximum error.

Parallel improvements have been made on transmissions still using the follow-up valve and mechanical linkage feedback, particularly a new type solenoid, a dynamic coil solenoid. This solenoid is similar to a dynamic radio speaker magnet; it completely eliminates any electrical hysteresis and provides greater accuracy of positioning and increased force with which to move the valve spool. The need for describing the response of hydraulic units in terms acceptable in present day servo tech-

(Continued on page 31)

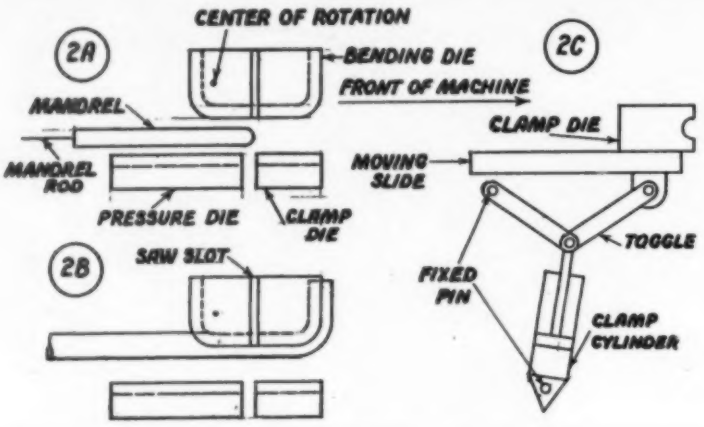


Fig. 2. 2a shows the bending tools—clamp, pressure and bending dies, mandrel and mandrel rod; 2b shows the bending die rotated into the material advanced by the mandrel; 2c illustrates the toggle action for advancing and retracting the clamp die.

CONTROL CIRCUITS

(Continued from page 17)

the machine. The machine cycle is as follows:

(1) Material is slid over the mandrel until the front end of the material is even with the front end of the clamp die;
(2) The clamp die moves toward the bending die, clamping the material between bending and clamp dies;
(3) The pressure die moves toward the bending die to hold the rear portion of the tube in place;
(4) Clamp die and bending die rotate in counterclockwise direction about center of rotation for 90 degrees;
(5) Rotary motion stops;
(6) Mandrel is pulled toward rear of machine by the mandrel extractor cylinder;
(7) A rotating circle saw advances down through the saw slot in the bending die, cutting the tubing;
(8) The saw returns up and air starts to blow to remove chips and the piece cut off;
(9) The pressure die and the clamp die retract to their original positions;
(10) The mandrel moves forward, carrying the material with it;
(11) Clamp die and bending die rotate back to their original position. Air stops blowing;
(12) The clamp die moves forward and sequences 2 through 11 repeat.

The first piece cut off is just a straight piece of tubing, but successive cuts each furnish a finished 90 degree bend. When the mandrel advances carrying the material, it moves the material forward the proper distance so the front part of the bending die rotates into it on the return, as shown in Figure 2b. The mandrel, being inside the material, is not shown.

Let us see how each of these motions or operations are performed. Referring to Figure 1, we see the front end of the machine with the swinging arm rotated 90 degrees. The material has been cut and the

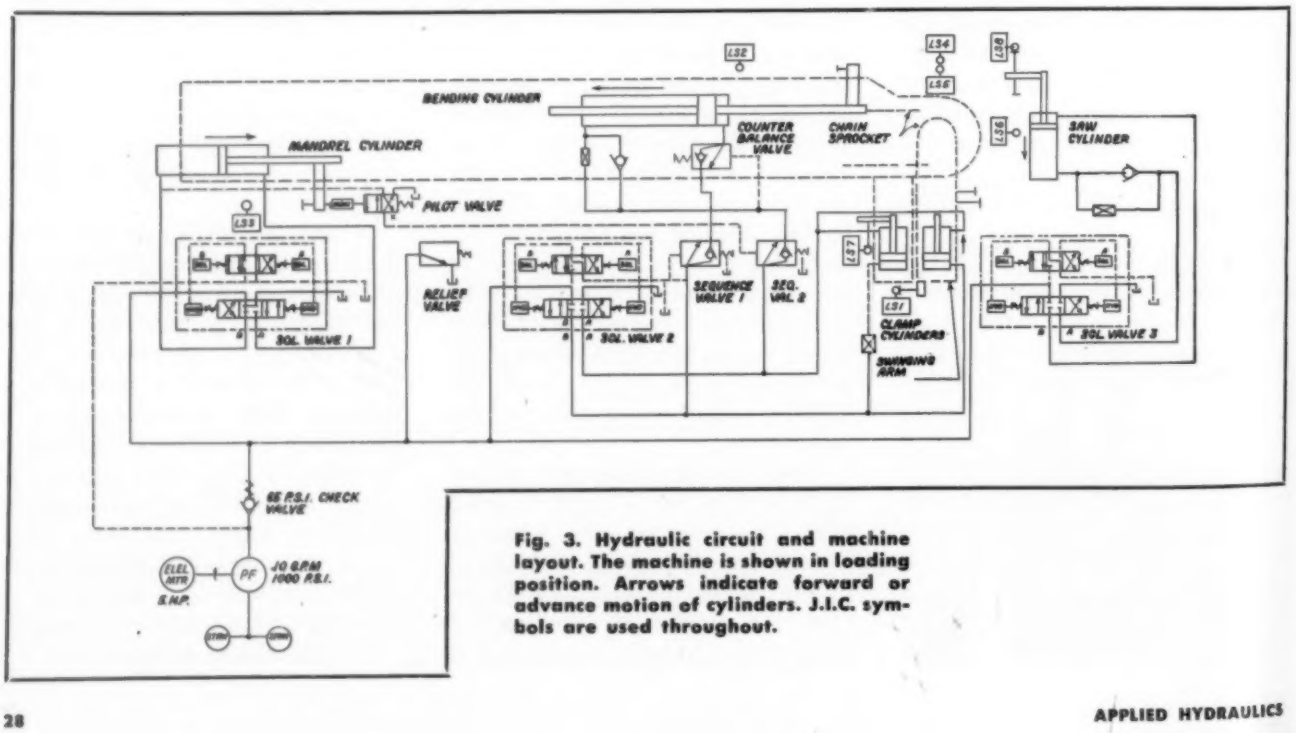


Fig. 3. Hydraulic circuit and machine layout. The machine is shown in loading position. Arrows indicate forward or advance motion of cylinders. J.I.C. symbols are used throughout.

clamp die retracted. As shown, the machine was set up to bend small diameter tubing, ½ in OD, two pieces at a time. This necessitates double dies and two mandrels. Both the clamp and pressure dies are advanced by the toggle action, activated by clevis mounted single end hydraulic cylinders. The clamp cylinder is mounted between the two side plates of the swinging arm and cannot be seen in Figure 1. The toggle action is shown in Figure 2c. It is clear that when the piston moves up the clamp die advances and vice versa.

The saw and motor are also shown in Figure 1; the hydraulic cylinder for actuating the saw is mounted between the two plates comprising the mounting assembly. Hydraulic hoses to this cylinder can be seen just below the motor.

The mandrel extractor cylinder is mounted at the rear of the machine and the bending cylinder is inside the machine. The relative positions of all cylinders are shown in hydraulic circuit diagram, Figure 3. The bending cylinder rotates the swinging arm by use of a chain and sprocket. The chain also passes around an idler sprocket at the rear of the machine and is attached at the rear end of the bending cylinder rod.

J.I.C. symbols are used for both the hydraulic circuit diagram, Figure 3 and the electric circuit drawing, Figure 4.

As shown in Figure 3, the following valves and accessories were used:

Solenoid valve No. 1: a four-way spring centered pilot operated valve. When in neutral, ports A and B are blocked and port P connects to port T. This valve is, in turn, controlled by a four-way solenoid operated pilot valve.

Solenoid valves Nos. 2 and 3: Four-way spring centered pilot operated valves, similar to valve No. 1 except that in neutral position all ports are blocked.

Relief valve: Ordinary relief valve, set between 1000 and 1200 psi.

Sequence valve No. 1: Standard pressure sequence valve with built-in check valve for return free flow.

Sequence valve No. 2: Same as sequence valve No. 1 but remote controlled.

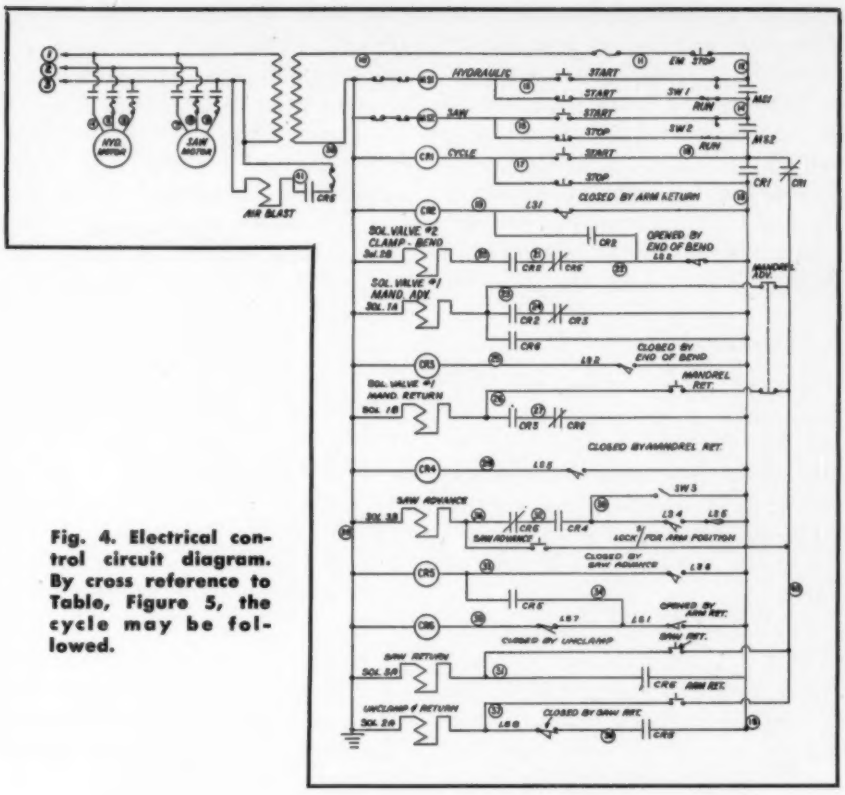


Fig. 4. Electrical control circuit diagram. By cross reference to Table, Figure 5, the cycle may be followed.

Counterbalance valve: Similar to sequence valve No. 2 but internally drained.

65 psi check valve: Similar to standard check valve but requiring 65 psi of oil pressure to open it in its ordinary free flow direction.

Pilot valve: A four-way spring offset, manually operated pilot valve.

Oil pressure is supplied by a 10 gpm vane type pump, direct-driven by a 5 hp 1200 rpm motor. When the machine is not cycling the oil from the pump flows through the 65 psi check valve and through solenoid valve No. 1, back to the oil tank. This allows the pump to operate under the 65 psi load only while the machine is inoperative. The 65 psi is maintained between the pump and check valve to shift the spool in solenoid valve No. 1 when one of its solenoids becomes energized. Energizing solenoid A on the No. 1 valve causes oil to flow from port B to the rear of the mandrel cylinder. Energizing solenoid B causes oil to flow from port A to the front end of the mandrel cylinder. Accordingly, energizing solenoid A advances the mandrel and energizing solenoid B retracts or returns the mandrel.

Analyzing solenoid valve No. 3, we see that energizing solenoid B will advance the saw and energizing solenoid A will return it.

Energizing solenoid B on valve No. 2 directs the oil from port B to the back end of the clamp cylinders to advance the clamp dies. After both cylinders have advanced, the pressure rises and oil forces its way through sequence valve No. 1, through the check valve in the counterbalance valve to the bending cylinder. The bending cylinder moves toward the rear of the bender pulling the roller chain and rotating the swinging arm. Energizing solenoid A causes oil to flow from port A to the front end of the clamp cylinders. When the clamp cylinders return, the flow of oil through solenoid valve No. 2 stops, because sequence valve No. 2 requires pressure from a remote source to open it. This prevents the swinging arm from returning until the mandrel cylinder has moved forward, shifting the pilot valve and allowing oil to flow to sequence valve No. 2. Oil flowing to the return end of the bending cylinder also opens the counterbalance valve allowing the oil to flow out of the front end of the cylinder.

The check valve and needle valves in the bending cylinder and saw cylinder lines are used as speed controls, while the needle valve in the pres-

sure die cylinder line restricts the flow of oil just enough to cause the clamp die to close or open first.

By energizing the proper solenoids at the proper time the original cycle can be reproduced. It should be observed that solenoid valve No. 1 must always have one of its solenoids energized to maintain pressure in the system during operation.

Electrical Control Circuit

The job of energizing the solenoids at the proper time is handled by the electrical control system. The electrical schematic diagram is shown in Figure 4. The relative positions of the eight limit switches are shown in Figure 3. They are:

LS1: Actuated by arm return;
LS2: Actuated at end of bend;
LS3: Actuated by mandrel return;
LS4 and LS5 are interlocks and will be explained later;
LS6: Actuated by saw advance;
LS7: Actuated by saw return;
LS8: Actuated by unclamp.

The table, Figure 5, shows when each solenoid is energized during the cycle and also when each limit switch is actuated and when each relay is energized. We will run through the electrical sequence briefly and the reader can follow the electrical cycle through by using the table. We will assume the hydraulic motor and saw motor are running and that the machine is in loading position, as shown in Figure 3. Pressing the cycle start button energizes CR1 (control relay No. 1) and creates a holding circuit through a CR1 contact and the stop button. CR1 also energizes the rest of the control panel. As the swinging arm is back, it is holding LS1 closed and CR2 becomes energized. CR2 N.O. (normally open), contacts complete circuits, energizing solenoid B on valve No. 2 and solenoid A on valve No. 1. CR2 also creates a holding circuit through LS2. Energizing solenoid 1A (solenoid A on valve No. 1) maintains pressure in the system only as the mandrel is already forward.

Energizing solenoid 2B causes the machine to clamp and bend. When the bend is completed, LS2 is actuated and the N.C. (normally closed) contacts open, de-energizing solenoid 2B and CR2. The N.O. contacts on LS2 close, energizing CR3. CR3 contacts de-energize solenoid 1A and energize 1B. This returns the mandrel, actuating LS3 and energizing CR4. CR4 energizes solenoid 3B, providing LS4 and LS5 are closed.

LS4 and LS5 are interlock switches, so adjusted as to prevent the saw from advancing if the bending die slot does not line up with the saw blade. If the arm overtravels, it opens LS5 and if it undertravels it does not close LS4. Assuming the arm is positioned correctly and LS4 and LS5 are both closed, then CR4 energizes solenoid 3B and the saw advances. This actuates LS6, closing its N.O. contacts and energizing CR5. CR5 creates a holding circuit through LSI. A CR5 N. C. contact opens, dropping out solenoid 3B. Two CR5 N.O. contacts close, one energizing solenoid 3A and one in the solenoid 2A line. When the saw returns, it closes LS8, completing the circuit through CR5 contact to energize solenoid 2A. This returns the clamps, closing LS7 and energizing CR6. CR6 de-energizes solenoid 1B and energizes solenoid 1A, causing the mandrel to advance. This depresses the manually operated pilot valve, directing pressure to open sequence valve No. 2, allowing the arm to return. The arm, when returned, actuates LS1. The N.C. contacts of LS1 open, dropping out CR5 and CR6 which, in turn, drops out solenoids 3A and 2A. CR4, having been de-energized when the mandrel advanced and CR3 de-energized when the arm started to return, the cycle is now completed and all relays ex-

Fig. 5. The sequence of energizing of each solenoid and relay and the actuation of each limit switch in the cycle.

	SOLENOID VALVES						LIMIT SWITCHES								CONTROL RELAYS					
PERIOD	Solenoid Valve 1 B	Solenoid Valve 1 A	Solenoid Valve 2 B	Solenoid Valve 2 A	Solenoid Valve 3 B	Solenoid Valve 3 A	LS1	LS2	LS3	LS4	LS5	LS6	LS7	LS8	CR1	CR2	CR3	CR4	CR5	CR6
CLAMP	—	E	E	—	—	—	A	N	N	N	N	N	←	A	E	E	—	—	—	—
BEND	—	E	E	—	—	—	←	→	N	→	N	N	N	A	E	E	—	—	—	—
MANDREL RETURN	E	—	—	—	—	—	N	A	→	A	N	N	N	A	E	—	E	—	—	—
SAW ADVANCE	E	—	—	—	E	—	N	A	A	A	N	→	N	←	E	—	E	E	—	—
SAW RETURN	E	—	—	—	—	E	N	A	A	A	N	←	N	→	E	—	E	E	E	—
UNCLAMP	E	—	—	E	—	E	N	A	A	A	N	N	→	A	E	—	E	E	E	—
MANDREL ADVANCE	—	E	—	E	—	E	N	A	←	A	N	N	A	A	E	—	E	—	E	E
ARM RETURN	—	E	—	E	—	E	→	←	N	←	N	N	A	A	E	—	—	—	E	E

E = SOLENOID OR RELAY ENERGIZED THROUGHOUT PERIOD
A = LIMIT SWITCH ACTUATED THROUGHOUT PERIOD
N = LIMIT SWITCH NOT ACTUATED THROUGHOUT PERIOD
→ = LIMIT SWITCH ACTUATED AT END OF PERIOD
← = LIMIT SWITCH RELEASED AT START OF PERIOD

cept CR1 and all solenoids are de-energized.

At the same time CR5 and CR6 are dropping out, the N.O. contacts on LS1 close, energizing CR2 and start the cycle over.

It should be pointed out that CR5 also energizes the solenoid operated air valve, allowing air to eject the chips and finished material.

The motor starter holding contacts are interlocked into the circuit, preventing energization of CR1 unless both motors are running. If, in setting up the machine, it is desired to operate without the saw motor running, SW2 may be turned to its jog position. By turning SW1 to jog and energizing CR1 with the start button, the electrical cycle can be started. The machine may then be inched by pressing and releasing the hydraulic start button. This starts and stops the hydraulic motor allowing it to pump oil intermittently for the jogging or inching action.

Additional buttons are provided for manually positioning the machine should it be stopped during a cycle by the emergency stop button. These buttons are rendered inert whenever the machine is running by the N.C. contact on CR1. SW3 is also provided to shunt LS4 and LS5 for set up purposes.

HYDRAULIC EQUIPMENT ON MODERN AIRCRAFT

(Continued from page 27)

niques has led not only into an investigation of the existing characteristics of equipment, but also into a program of design revisions. Some of these revisions are intended solely for the purpose of improving response, while others have been general mechanical and hydraulic improvements.

Since the advent of sonic and supersonic aircraft, greater demands are being made on hydraulic systems. For the units being developed for pilot-less aircraft, pressures up to 4500 psi and speeds of 9000 rpm are contemplated. A typical hydraulic system of this type, consisting essentially of a variable displacement pump and a fixed displacement hydraulic motor, employs a hydraulic motor weighing less than two pounds with an output of 10 hp, with the extremely favorable horsepower to weight ratio of 5:1.

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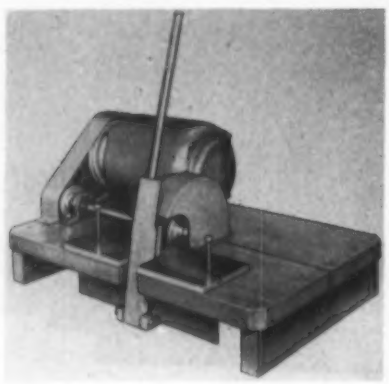
Hose Cut-Off Machine

Aeroquip Corporation announces that their new hose cut-off machine is now in production. Sturdy, compact and easy



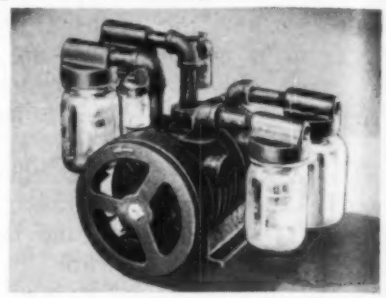
to operate, the Aeroquip hose cut-off machine can cut all types of flexible hose to 3 in OD, even hose reinforced with plies of wire braid. All moving parts of the machine are guarded, no coolant is required for the cutting wheel.

New VEE Packing

Linear Incorporated has just announced its new VEE-DAM packing development, which they believe is one of the most important innovations made in the field and an improvement in the Linear "Par" design V-packing. The new VEE-DAM packing provides for control of labyrinth flow independent of joints without sacrificing flexibility, smoothness, low friction or strength of the basic "Par" design packing. The new fabric reinforced VEE-DAM V-rings are already being produced for rams over 20 in in 5/8, 3/4, 7/8 and 1 in sections. Other diameters and sections will shortly be available. *2.*

Rotary-Vane Air Pumps

Gast Manufacturing Corporation announces three new rotary-vane air pumps, specially engineered for automatic feeding operations and now available for original equipment applications. Two dual chamber models—the smaller delivers 9 cfm from each chamber, vacuum to 20 in or pressure to 20 psi; the larger delivers 14 cfm from pressure chamber and 9 cfm from vacuum chamber, 15 in of vacuum or up to 15 psi pressure; the single chamber pump produces moderate pressure or vacuum



with volume of 19 to 24 cfm. All three models are equipped with ball bearings and V-belt pulley with integral fan for cooling and drive. *3.*

Check and Needle Valves

Two new valves for air and hydraulic use—the Vernier Type needle valve and Floating Ball check valve—have been

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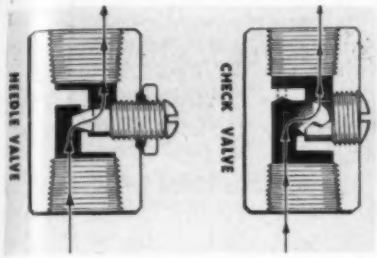
recently introduced by Pneu-Trol Devices, Inc. Both valves combine extreme sensitivity with rugged construction to provide maximum utility and service.



The needle valve has a long tapered needle, which allows a fine vernier adjustment. The floating ball of the check valve is extremely sensitive to the slightest change in flow direction. The check valve is readily converted to a fixed orifice control valve by drilling a predetermined reverse flow orifice through the entry port of the valve body. Both valves are only slightly larger than pipe size and available in brass bodies for pressures to 1000 psi and steel bodies for pressures to 5000 psi; both are also available in sizes ⅛ to ¾ in pipe sizes, fuel thread. *4.*

Circulator Pump

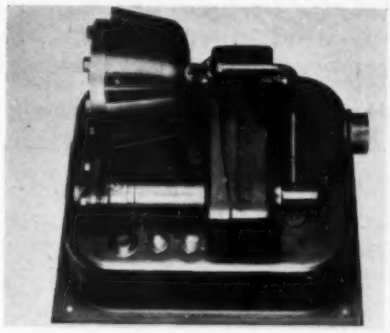
The Piqua Machine and Manufacturing Co. now offers a new "Enpo" circulator pump, a non-clogging, high capacity pump for coolant, re-circulation and transfer applications. With a capacity of more than 40 gpm at 10 foot head, high efficiency and power factor, armored motor, the pump is easily serviced without disturbing piping. *5.*

Two-Pressure Solenoid Air Valve

The new "Mac" air valve, a four-way, five-port, two-pressure solenoid operated air valve, has just been added to the line of Mechanical Air Controls, Inc. Featuring the same compactness of design, full orifice area and simplicity of construction of this company's other valves, it makes available a real economy in the operation of double acting cylinders. The two inlet ports allow full line pressure to be applied to the work stroke of an air cylinder and much lower pressure to the return stroke, effecting a real saving in compressed air. High or low pressure can be applied to either inlet port and pressures can be reversed. "Mac" patented "O" ring type seals maintain the air pressure sealing feature of the poppet type valve, as well as providing the ease of operation of the direct solenoid balanced type valve. The pressure range is 20 to 150 psi; ⅜ and ¾ in pipe sizes are available. *6.*

Magnetic Clutch Flow Meter

A new type of flow meter featuring a magnetic clutch to transmit the movement of the float is announced by The Hays Corporation. The new meter, the Hays-Penn Magna-Clutch provides, according to the manufacturer, more power with less friction, due to the



exceptionally large float and long float travel. The movement of the float is transmitted through a pressure tight manometer by means of the magnetic clutch. The construction eliminates the stuffing box and its friction, leakage and maintenance and makes for sustained accuracy. Six types or combinations of recording, indicating and integrating meters are offered and five adjustable range tubes with 17 in to 750 in water differential and working pressures of 1500 and 2500 psi, convertible in the field. *7.*

New Line of Pilot Valves

The Hanna Engineering Works announces a new series of small, efficient pilot valves for direct control of small cylinders or automatic control of large cylinders. The pilot valves are available in cam, lever, push button or foot operated types; all valves are three-way except the foot operated units which are four-way. The cam operated valves feature a spring loaded roller which can be actuated by a straight line or rotary cam. The roller in this unit and the

(Continued on page 37)

Lindberg Air & Hydraulic Cylinders are available in a complete range of mountings—with any length of stroke.

- ★ **Hydraulic Cylinders for pressures to 1500 PSI**
- ★ **Ten standard bore sizes from 2" to 8" inclusive**
- ★ **Standard air cylinders for pressures to 150 PSI**
- ★ **Mill-type heavy duty air cylinders for pressure to 250 PSI**
- ★ **Twelve standard bore sizes from 2" to 12" inclusive**
- ★ **Cushioned or non-cushioned**
- ★ **Non-rotating—double acting**
- ★ **Special cylinders built to order**

Write for Bulletin 700, "Hydraulic Cylinders," or Bulletin AC-2, "Air Cylinders"

LINDBERG AIR & HYDRAULIC CYLINDERS

Lindberg Engineering Company, 2441 West Hubbard Street, Chicago 12, Ill.

Useful Literature

The publications listed are available without charge. Mark the initial key number on the card bound in this issue and mail.

28. Handbook on Hydraulic Oils . . . A new edition of the Houghton Handbook on Hydraulic Oils has been issued by the E. F. Houghton & Co. An outstanding new chapter on the flushing of hydraulic systems has been added. This chapter discusses the different procedures used in flushing of hydraulic systems which have become contaminated and recommends an improved procedure. Other chapters in the revised handbook deal with hydraulic oil specifications, the importance of properties not in specifications, additive treatment of hydraulic oils, trouble shooting, the qualities necessary in a good hydraulic oil and a discussion of Hydro-drive hydraulic oils.

29. Low Pressure Cylinders . . . Hanna Engineering Works has just issued Catalog No. 230, on their low pressure cylinders. In this attractively presented 20-page catalog the standard models are shown with full specifications. Cross sections show the typical cylinder construction and the types of adjustable cushions which can be furnished for either or both ends of standard cylinders. Clevises, mounting brackets, piston rod protective boots and optional rod ends are also shown.

30. Auxiliary Unit Plan . . . Bulletin No. 780R, The Wayne Auxiliary Unit Plan, describes the plan for decentralizing industrial air supply, gives case histories and examples of the savings made by this plan. The plan, as outlined, is claimed to be effective for large as well as for moderate and small size shops and plants.

31. Industrial Catalog . . . The new industrial catalog of A. Schrader's Son division of Scoville Manufacturing Co., Inc., is now ready for distribution. Featured are the new Hydrodial hydraulic gauges. These gauges embody the direct action princple of Schrader standard gauges, the large dial, white face and large numerals make them legible 50 feet away. The new gauges have a built-in snubber, are completely enclosed and are available in nine calibration ranges, 5-50 to 1500-5000 pounds. Service is made easy by the incorporation of many of the standard parts of Schrafer standard gauges.

32. Flexible Metal Hose . . . Catalog 100, a new brochure on flexible metal hose, has just been released by the Atlantic Metal Hose Co., Inc. The catalog covers recent developments in interlocking and seamless hose as a flexible medium for many industrial applications. New uses for existing types of flexible metal hose are suggested and the development of new types of hose to meet problems encountered by Atlantic's engineering department are discussed. The catalog is well indexed for quick reference to hose, couplings, nipples and other accessories.

33. Rotary Pump Catalog . . . The Geo. D. Roper Corporation has issued Catalog 950, a condensed listing of their Series 3600, F, K and H rotary pumps. Illustrations, specifications, construction features, dimensional drawings, materials and other essential data are included. Standard Roper gear pumps are available for a wide range of hydrau-

CHOOSE THE AIR VALVE YOU HELPED DESIGN

FOR AIR CYLINDER CONTROL
FULL FLOW • COMPACT • ONE MOVING PART
PRECISION SPOOL AND BORE THAT IS
HARD CHROME PLATED FOR EXTRA LIFE
BALANCED TYPE "AIR PRESSURE SEALED"

TWO BASIC
PIPE SIZES
3/8" - 3/4"

MAC
MECHANICAL AIR CONTROLS, INC.
3049 EAST GRAND BOULEVARD
DETROIT 2, MICHIGAN

CAM VALVE | PILOT CONTROLLED VALVE | FOOT VALVE | DOUBLE SOLENOID VALVE | SOLENOID VALVE | TWO PRESSURE VALVE

Write for Catalogue

lic, process and general industrial applications. Examples of special built Roper pumps for original equipment manufacturers are also shown.

CIRCLE NUMBERS ON THE CARD AND MAIL!

34. Feed Controller . . . Bulletin No. DC-208 in the new "Power-Check" precision feed controller, just placed into regular production, has been issued by National Pneumatic Company. The Power-Check is a self-contained hydraulic cylinder and operating rod, which, with its fittings, is used to set up a retarding pull at a given control point of feed travel; the operating rod can be attached to a drill press spindle bracket, an air cylinder piston rod or to a bracket on the feed table of a milling machine or grinder or to an air cylinder piston rod if the table is air operated. The standard units are available with 2, 3, 4 or 6 in stroke.

35. Pneumatic Cylinder Catalog . . . New Catalog 20A, which supercedes current catalog of the same number, has been issued by James L. Entwistle Co. The catalog gives full specification data and parts list of the four standard models of non-cushioned cylinders made by this firm. Photographs of applications are included.

36. Cylinder Data Sheets . . . Ledeen Mfg. Co., makers of hydraulic and pneumatic actuating cylinders, has issued Bulletin CS 649, in their series of technical bulletins, describing the use of hydraulic cylinders for controlling large gate valves in paper mills or chemical plants. Actuating cylinders are illustrated and details are given.

37. Industrial Air Power Catalog . . . The 48-page general catalog of Mead Specialties Company presents the entire line of Mead air operated devices and components. Valves, feeders, presses, fixtures, timers, impact hammers, cylinders, both single and double acting, vises and accessories are shown.

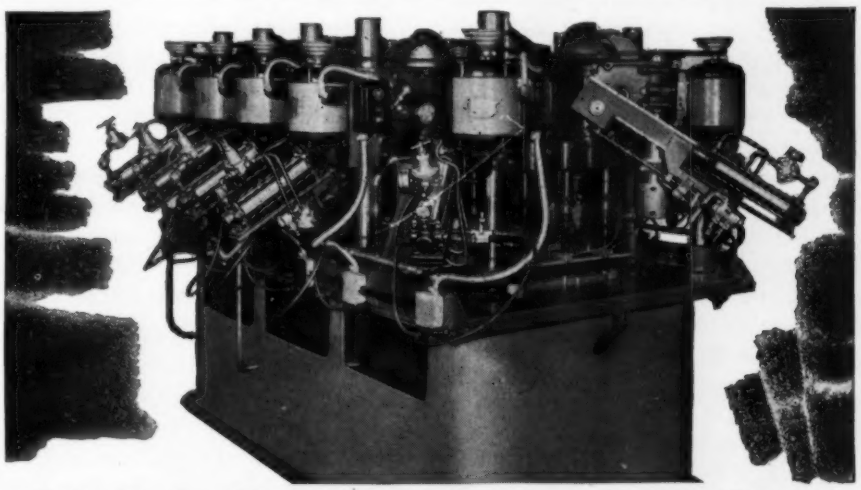
38. Control Catalog . . . Catalog 52F, a 64-page file size catalog, lists the complete line of automatic pressure, temperature and flow controls made by General Controls. An additional data section lists products not shown in previous catalogs. Full specifications and engineering information is given.

39. Solenoid Operated Valve . . . Bulletin 493, describing the new Series M3, bronze-body solenoid valves, has been issued by Skinner Electric Valve Division. The four-page bulletin shows a cross section of a typical design, explains normally closed operation, includes dimensions, specifications and charts of capacities and pressure drop in handling water and air.

40. Air Separators . . . A leaflet issued by Chicago Manufacturing & Distributing Co. describes the Textite Separator, a triple action, centrifugal type unit for cleaning and drying compressed air, gas or steam. The separator is available in four sizes, capacities of 25 to 250 cfm and pipe sizes ½ in to 1½ in.

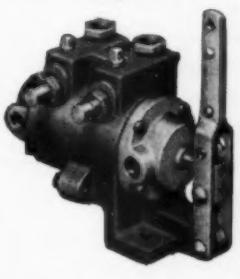
41. Air Compressors . . . Catalog IDC 9302-7 decribes the two sizes of the two-stage air cooled air compressors made by the Industrial Division, The Westinghouse Air Brake Co. The 2-CMB, vertical two cylinder compressor and the 3-CMB, a three cylinder compressor, with two low pressure cylinders at 30 degrees above the horizontal and the high pressure cylinder vertical between them. Both units are designed for continuous operation at 150 psi to displace 92 cfm and 203 cfm at maximum pressure.

42. Needle Valves . . . Circular No. 568, being distributed by The Lunkenheimer Company, lists the types of full-way and throttling needle valves offered by this company. Seat opening bronze and steel valves are shown, the latter in sizes ⅛ to 1 in for pressures to 3000 psi.



12 Spindles of Automatic Drilling Machine are NOPAK Operated

NOPAK *Reciprotrol* 4-Way Valves automatically control Speed-and-Length-of-Stroke of Reciprocating Cylinders.



12 NOPAK Reciprotrol Valves Actuate 12 NOPAK Cylinders

Twenty-four ⅝" holes are drilled every 15 seconds by this high production machine, specially built for the U. S. Government by Dorr Sales Co., Milwaukee, Wis. Feeding and retraction of the 12 drill press spindles is fully automatic once the master control valve (a NOPAK ⅜" 4-way operating valve) is opened.

The master valve trips twelve ⅜" NOPAK Reciprotrol Valves which actuate 12 NOPAK 3" x 10" Model "A" Cylinders. Each cylinder "feeds" one of the 12 large, double-spindle, drill-press heads, retracting the spindle after the hole is drilled. The 12 cylinders operate automatically at a pre-determined stroke speed, governed by the Reciprotrol Valves, and depending upon the size of hole and thickness of metal to be drilled.

Write for Special Bulletin on NOPAK Reciprotrol Valves.

GALLAND-HENNING MFG. CO.
2743 SOUTH 31st STREET
MILWAUKEE 7, WISCONSIN

NOPAK
VALVES AND CYLINDERS
DESIGNED for AIR and HYDRAULIC SERVICE

Representatives in Principal Cities

Representatives in Principal Cities. Here are a few:—

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292 Highland Ave.,
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FRANK E. BLACK
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Baltimore 2, Md.

ROSS ENGINEERS
230 Crescent Ave.,
Buffalo 14, N. Y.

D. E. RANDALL
11003 Ashbury Ave.,
Cleveland 6, Ohio

GARRETT BURGESS, INC.
5050 Joy Road,
Detroit 4, Mich.

PURCELL BROTHERS
3344 Erie Ave.,
Cincinnati 8, Ohio

JOHN HENRY FOSTER CO.
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St. Louis 18, Mo.

E. C. WILD
1106 So. Lincoln St.,
Denver 9, Colorado

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32 No. Holman St.,
Portland 11, Oregon

TRANSMISSION ENGINEERING CO.
53 Stevenson St.,
San Francisco 5, Calif.

JOHN G. SPOTTON
4233 Dundas St. W.
Toronto 18, Ont.

ECONOMIES IN POWER

(Continued from page 21)

The unit supplying oil hydraulic pressure to the leveler hold-downs and to the toggle cylinder on the shear consists of a 30 hp, 1200 rpm, 220 v, 3-phase, 60 cycle, double ended motor connected to two 30 gpm variable volume pumps through couplings, giving a total volumetric capacity of some 60 gpm at the pump discharge. The toggle cylinder is an 8 in bore x 6 in stroke, trunnion mounted cylinder, with 2:1 differential rod, cushioned at both ends.

The shear circuit is controlled by a two position, 4-way balanced piston type valve. The use of two 5-gallon accumulators instead of a single 10-gallon accumulator originally considered, permitted the type of rapid flow which was required for this operation. A 120-gallon reservoir with breather, oil level gauge, suction strainers and a cooling coil holds the oil at a safe, efficient operating temperature for continuous operation.

Radial Drill Track Clamping

The Carlton Machine Tool Company, Cincinnati, Ohio, manufacture a travelling base radial drill, traversed by power along a track, thereby covering a very large work area. When the machine has reached a drilling position, it is essential, for precision work, that the base be clamped securely to the rails. According to Mr. W. Weidig of the Carlton Company, it is very important that the pumping system for the clamps be as compact as possible. A one quart hydro-pneumatic accumulator in the power pack mounted on the base, Figure 3, eliminated the necessity for a large pumping system and kept the base of the radial drill "clean".

The drill is mounted on a truck base, suspended on four car wheels. A pushbutton on the head of the machine operates a 3-way solenoid valve, actuating the four rail clamp shoes which are raised to catch the underside of the rail head, clamping the assembly securely to the rails, and holding it under direct hydraulic pressure maintained by the accumulator.

The hydro-pneumatic accumulator makes it practical to use the smallest possible unit to maintain pressure; it has sufficient supply of fluid for several clampings; and it maintains a constant clamping pressure regardless of irregularities of the rails.

Wire Cutting Cycle

The Animal Trap Co. of America of Lititz, Pa., required fast action on its automatic wire cutting machines. Mr. Milton A. Hopf, superintendent, reported that the machine required the stroke to be completed in .0546 seconds. They were equipped with 2 in diameter x 1½ stroke cylinders, used with a pump delivering 16 gpm, which gave them a speed of .076 seconds. Previous suggestions to achieve the speed required had pointed to the use of larger capacity pumps, which for the small equipment of the type used by this company, was impractical.

A one gallon hydro-pneumatic accumulator, incorporated into the circuit, solved the problem by shortening the cycle within the time limit of the machine cycle. The advantages included reduced power requirements over a larger pumping unit with saving in operating cost, economy of space and increased speed of action.

Locking Device for Pneumatic Die Cushions

A very interesting use of a hydro-pneumatic accumulator as a part of a hydraulic locking device for pneumatic die cushions is reported by Mr. W. E. Richcrook of the Minster Machine Co. of Minster, Ohio. This device makes it possible to lock the die cushion at the bottom of the stroke when deep draw work is being done on the press. The die cushion is released only when the slide or ram of the press has reached a point on the upstroke at which the drawn part can be completely cleared of the upper die when ejected by the suction action from the lower part of the die.

This operation, while it does not increase the production speed, it does make it possible to prevent damage to the piece as it is stripped from the die by insuring that the die is in the clear before ejection of the drawn piece.

The lock is activated by air pressure and is released by exhausting the air. The point of locking and release is controlled by a rotary limit switch driven by the crank of the press.

The lock is filled with oil through the filler valve Figure 5, with the cushion in its "up" position and with accumulator uncharged. The filler valve, D, and valve E are opened for filling, then closed and the cushion cycled to its down position and

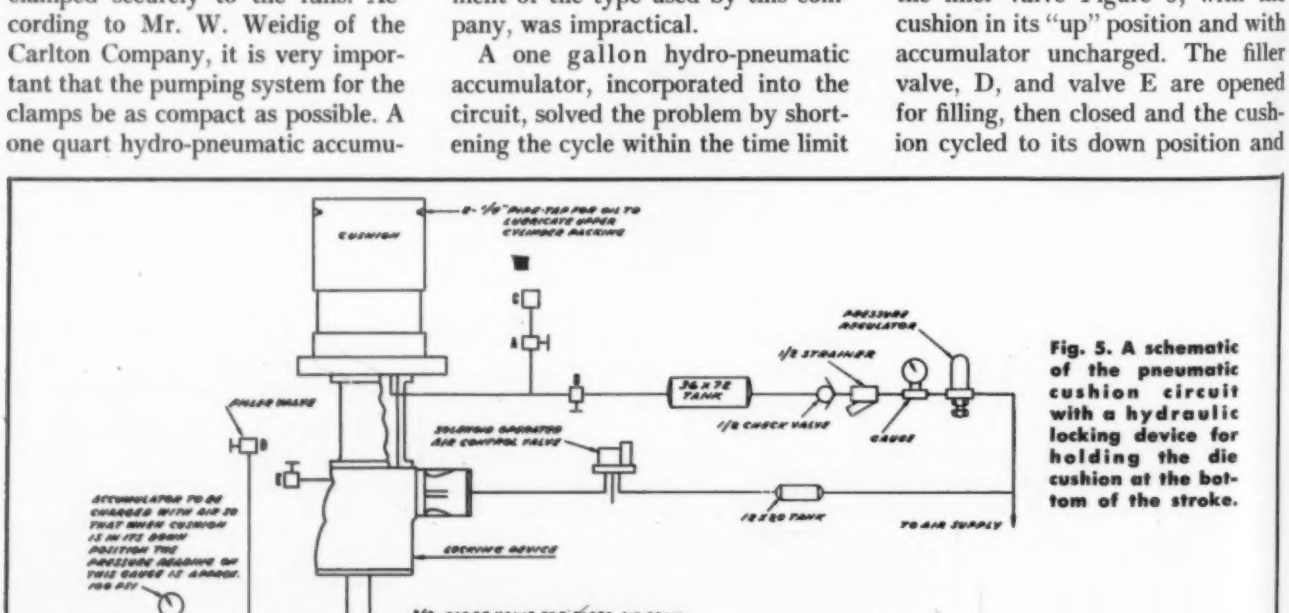


Fig. 5. A schematic of the pneumatic cushion circuit with a hydraulic locking device for holding the die cushion at the bottom of the stroke.

the accumulator charged with a maximum of 100 psi air pressure. Valves E and F are opened in turn to exhaust any air or emulsion, then closed.

Air is exhausted from the cushion cylinder by closing air valve B and opening air valve A, Figure 5. Then valve A is closed and cup C filled with oil, after which valve A is opened to drain oil into the system. Valve A is then closed and valve B opened, permitting the cushion to refill with air.

The speed of the cushion return on the upstroke is governed by metering the return flow of oil into the cylinder.

NEW PRODUCTS

(Continued from page 33)

lever in the lever operated unit both can be rotated 90 degrees. The push button valve is compact and is ideal for panel control installations. Both single and double pedal foot operated pilot valves are available. The single pedal valve offers semi-automatic control; the double pedal type gives full control of both directions of cylinder movement. Automatic control of large cylinders is achieved with pilot valves through Hanna Mastair valves. *8.*

High Pressure Throttle-Type Valve

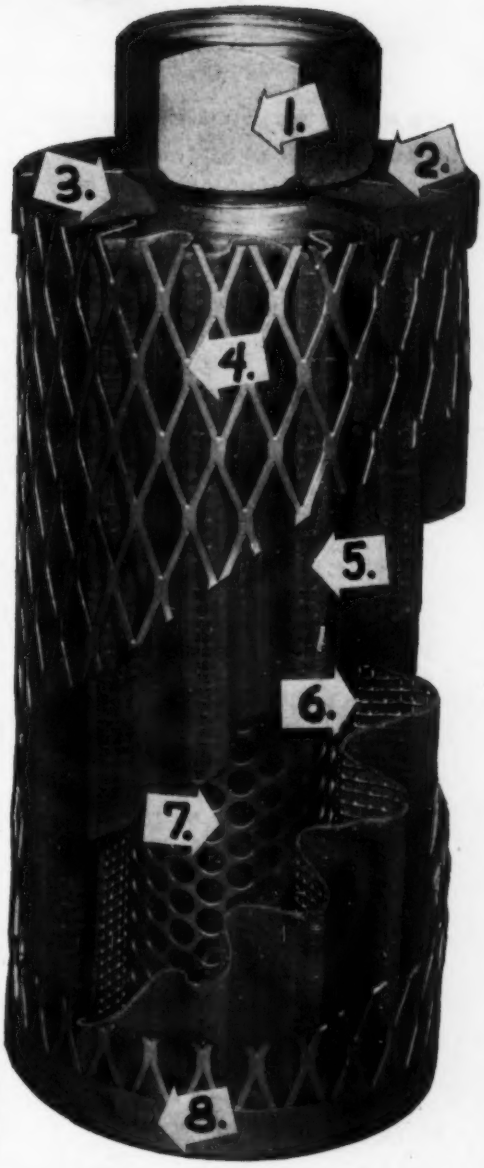
The "Protectomatic" valve, a high pressure hydraulic throttle-type valve, is announced by the R. D. Wood Company. Designed to control the falling speed of weighted-type accumulators and to prevent an accumulator tank or platform from crashing on its bumper blocks, the valve operates at from 1500 to 5000 psi working pressure. Ruggedly constructed throughout, the new valve is machined from solid forged steel blocks, with bronze bushings and stainless steel sliding plunger, seat and spindle. By automatically controlling and protecting accumulator fall, the valve prevents damage, downtime or the hazard of injury caused by pipe line failures. *9.*

New AN Scraper Rings

A new line of AN-6231 scraper rings, made in accordance with the new Army-Navy Specification AN-S-60, and for use in all types of hydraulic struts, actuators and cylinders, is announced by Gadgets, Inc. The scraper rings are a positive protective measure against the entrance of dirt, dust and other abrasive materials into a cylinder and preventing excessive wear on the "O" rings and moving parts. The company also offers a line of AN-6228 and AN-

TEST REPORT

TYPICAL POUR TEST ON MARVEL SYNCLINAL FILTER



This test was conducted to compute engineering data on Model A-1½ Filter.

Conditions of Test

Saybolt Universal Viscosity at 100 deg. F	319 sec.
Temperature of Oil During Test	100 deg. F.
Quantity of Oil Used for Test	5 gallons
Head Pressure	Pouring

Results of Test

	Marvel Eng. Co. Filter (Mod. A-1½)	Conventional Type Filter
Rate of Flow (gallons per minute)	33.6**	8.82***

**Twenty-three gallons of oil flowed through the filter per minute; however the conditions of the test allowed only 68.7% of the capacity of the filter to be used. By simple arithmetical calculation, the total capacity of the filter was estimated to be approximately 33.6 gallons per minute.

***Since this filter was full at all times, 8.82 gallons per minute represents its total capacity under the conditions of this test.

*Test by Phoenix Chemical Laboratories.

KEEP HYDRAULIC PRODUCTION LINES MOVING WITH CLEAN OIL

OVER 75 *LEADING* HYDRAULIC EQUIPMENT MANUFACTURERS NOW USING MARVEL SYNCLINAL FILTERS

Maximum Filtration Area in Less Space *Means 5 Times Longer Periods of Operation*—Affording the Longest Constant Protection to Hydraulic Systems

Marvel Synclinal Filters Can Be Quickly Taken Apart and Thoroughly Cleaned

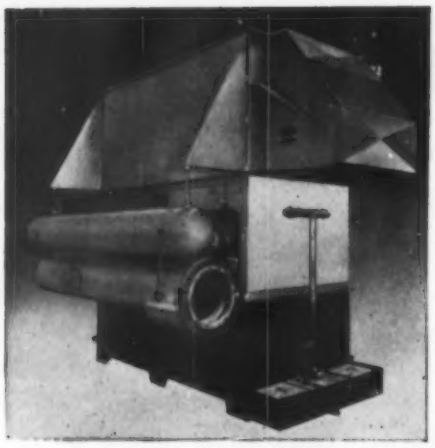
Write today for Catalog No. 103 containing complete engineering data.

Inquiries invited from established Sales Representatives or Dealers in hydraulic equipment.

1. Coupling
2. Top Cover
3. Sealing Washer
4. Expanded Metal Protective Housing
5. Reinforced Synclinal Filter Unit
6. Reinforcement of Wire Cloth
7. Perforated Centering Tube
8. Base Plate Welded to CenteringTube

MARVEL ENGINEERING COMPANY

625 West Jackson Blvd. Dept. 66 Chicago 6, Ill.



Niagara Aero After Cooler Patented

HOW YOU SAVE,
Getting Drier Compressed Air

● Direct saving in the cost of cooling water saves the price of the Niagara Aero After Cooler (for compressed air or gas) in less than two years.

Extra, for no cost, the drier air gives you a better operation and lower costs in the use of all air-operated tools and machines, paint spraying, sand blasting or moisture-free air cleaning. Water saving also means less expense for piping, pumping, water treatment and water disposal, or you get the use of water elsewhere in your plant where it may be badly needed.

Niagara Aero After Cooler assures all these benefits because it cools compressed air or gas below the temperature of the surrounding atmosphere; there can be no further condensation in your air lines. It condenses the moisture by passing the air thru a coil on the surface of which water is evaporated, transferring the heat to the atmosphere. It is installed outdoors, protected from freezing in winter by the Niagara Balanced Wet Bulb Control.

Write for complete information; ask for Bulletin No. 98

NIAGARA BLOWER COMPANY
Dept. AH, 405 Lexington Ave.,
New York 17, N. Y.
Over 35 Years of Service in Industrial Air Engineering
District Engineers in Principal Cities

INDUSTRIAL COOLING HEATING • DRYING
NIAGARA
HUMIDIFYING • AIR ENGINEERING EQUIPMENT

6229 "V" ring adapters. Both scraper and "V" rings are made in sizes from ½ in ID to 11 in, with many standard

sizes in stock. A commercial quality scraper ring is also available for applications other than aircraft. *10.*

Three-Way "ON" Air Valves

Mead Specialties Co. announces their new three-way, normally open or "ON" valves, the Mead FT-102, a companion to the previously announced "OFF" model, the FT-101. The new "ON"

valve has ⅜ in pipe thread apertures for quick response when used with air cylinders up to 6 in bore and operate with a very light touch on the handle-lever button. Another model, the FC-102, is the same valve minus the lever, for operation by means of a cam or trigger on the working machine. Both models have mounting holes at top and sides to facilitate attachment. Hose nipples, included, take ⅜ in ID and up to ¾ in OD air hose. *11.*

Dual-Pressure Air Compressors

The Kellogg Division, American Brake Shoe Company, announces two new dual-pressure, low cost portable air compressors. Both piston-type compressors offer two working pressures and two air deliveries by merely shifting a lever. Operating at 150 psi the units delivery 2.4 cfm or continuous operation at 50 psi delivers 3.2 cfm for many low pressure requirements. Both units (the difference is one is motor driven, the other gasoline engine driven) are available with or without a cart; both units are available for immediate delivery. *12.*

Strip Expander

A new, inexpensive, finger U Expander made in strip form and designed to fit a number of diameters of packings on hydraulic equipment has been developed by HPL Manufacturing Company. A specially rolled brass strip exerts proper mechanical pressure on the lip of the packing to maintain contact with the cylinder wall or plunger, where the pressure is very

PLENTY of POWER

IN THESE HYDRAULIC PUMPS and FLUID MOTORS

There's plenty of power in Eastern fluid motors and hydraulic pumps. They're tough and compact—ideal where space is at a premium. They're dependable, too. Long life under rugged operating conditions is built-in. An Eastern hydraulic pump or fluid motor in your design is good engineering.

SERIES 100

.1 to 5 GPM—Drive speeds up to 3450 RPM. Working pressures up to 1000 PSI. Average volumetric efficiency: 90%. Average model weight: 1.65 lbs.

Lightweight construction is obtained through use of aluminum housings and nitralloy gears and shafts. Each unit is factory pre-tested for precision and operating efficiency.

WRITE FOR FULL DETAILS

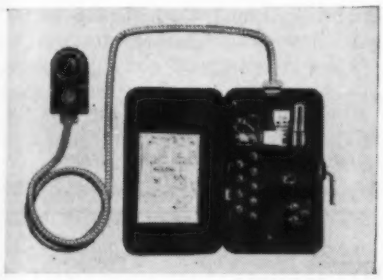
Eastern
INDUSTRIES, INC.
298 ELM STREET
NEW HAVEN 6, CONNECTICUT

low or builds up slowly. Produced in numerous heights and in strip form, it is merely necessary to cut off the re-

quired length of expander to fit the diameter of the packing. The manufacturer claims longer packing life and greater efficiency of operation. *13.*

General Purpose Photoelectric Control

A new standard, general purpose photoelectric control for industrial and machinery applications has been introduced by Photoswitch Incorporated.



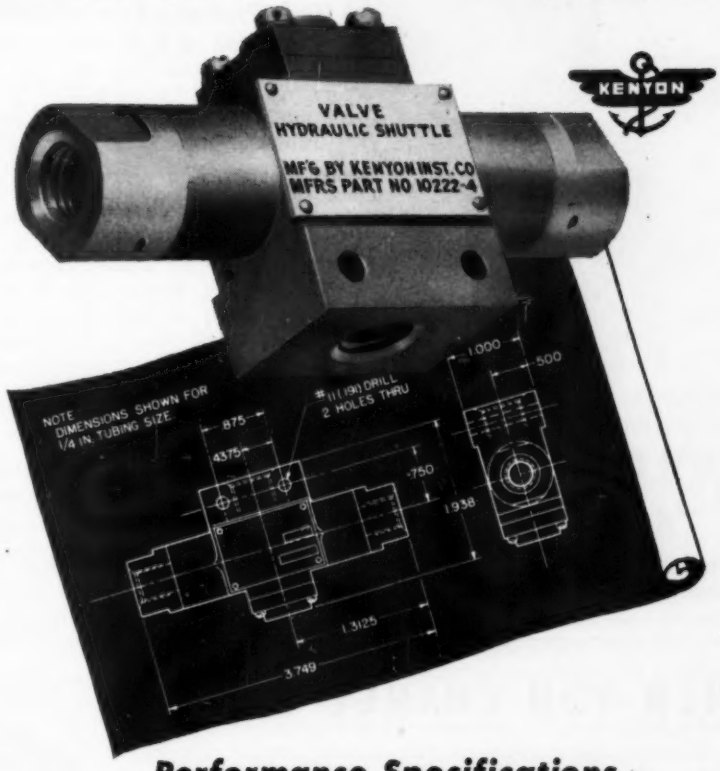
Known as Type 20DJI, the control provides precise, automatic control for motors or valves, short-range signal systems, conveyor control, counting, production inspection and stop-motion control in the textile, paper, wire and other industries. Type 20DJI control is available either integral with the housing or in a small separate housing (photograph); a tamper proof sensitivity adjustment permits positive operation over varying distances between phototype and light source under all conditions of mabient light. Rugged in design, with hermetically sealed, oil filled condensers and high wattage resistors and built to withstand vibration, the control is designed to provide reliable and continuous operation under conditions of extremely high temperature and humidity. *14.*

Liquid Leak Detector

A liquid leak detector is now being introduced for general use in hydraulic systems and closed liquid system by Highside Chemicals Company. The detector, known as "Trace," is red in color and indicates the presence of large or very small leaks by depositing a red film at the point of leakage. Trace is avail-

3,000 psi

SHUTTLE VALVE



Performance Specifications

✔ **SHUTTLING PRESSURE**
Valve shuttles at a maximum pressure of 50 psi.
Valve will not shuttle or permit inter-flow at pressures less than 25 psi.

✔ **SURGE FLOWS OR NEGATIVE PRESSURES** will not cause the shuttle to unseat.
Surge flows will not displace the seals.

✔ **LEAKAGE**
Less than two drops per cycle.
Static leakage (air or hydraulic fluid)—None.
Air leakage during shuttling—Less than 10 ml per cycle.

✔ **IMPULSE TEST**
No leakage or deterioration after 20,000 impulses.

✔ **SHUTTLING AGAINST PRESSURE**
Valve will shuttle against blocked line.

✔ **ENDURANCE**
No excessive wear or malfunctioning after 2,000 shuttling cycles.

✔ **EXTREME TEMPERATURE OPERATION**
Temperature range −65°F to +160°F.

✔ **PRESSURE DROP**
Less than 10 psi. at rated flow.

✔ **WEIGHT**
1/4 and 5/16 inch tube sizes .48 lb.

✔ **SIZE**
Envelope and mounting dimensions according to AN 6277 or to meet requirements.

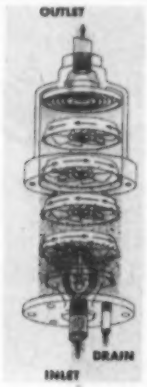
Write to Kenyon Instrument Co., Inc., 1344 New York Avenue, Huntington Station, L. I., N. Y.

KENYON
INSTRUMENT CO., INC.
HUNTINGTON STATION, L. I., N. Y.

able in a high grade lubricating oil medium for systems containing oil or fluids compatible with mineral oil. Its value in reducing maintenance labor costs has already been proven with aircraft hydraulic control systems. *15.*

Centrifugal Air Cleaner

The "Aridfier," a positive action, centrifugal type unit for purging moisture, oil, dirt, rust and other foreign matter



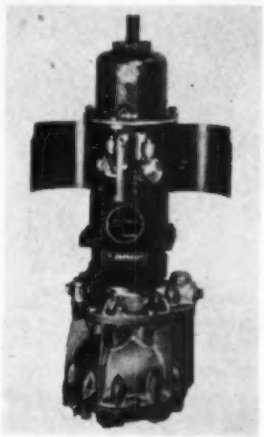
from compressed air, is a product of Logan Engineering Co. Installed between the air receiver or tank and the point of application, the Aridfier housing contains a vertical shaft concentric with the air inlet at the bottom and the outlet at the top. Four multi-blade rotors or impellers on the shaft are mounted so that alternate rotors revolve in the opposite direction. As the air passes through the rotors, they revolve at high speed, the centrifugal force throwing the impinged or collected impurities to the housing wall out of the air stream from where they drain to a trap. A wide range of sizes is available; sizes to 2 in are threaded for standard pipe, sizes 3 in to 10 in are fitted for standard pipe flanges. *16.*

High Pressure Service Cocks

A new line of high pressure, lubricated service cocks, for working pressures up to 125 psi on gas, oil or water lines, has been introduced by the Walworth Company. The compact service cocks have cast iron bodies and bronze plugs and are made with both screwed recessed ends and Dresser super service ends. The plug is held against its seat by a gland through resilient packing. Bodies and plugs are provided with a lubricant screw of cadmium-plated steel and a lubricant grooving system for "pressure-sealed" lubrication. *17.*

Transometer

The Askania Regulator Company has released specifications on a new model of its Transometer, which will generate an air pressure signal from 2-15 pounds, and which, because it eliminates the necessity for a transformer to convert low pressure signals, can be used directly with the present types of air operated controllers. The new Askania Transometer, with its extended pressure range, permits a broader application in the field of liquid flows.



Originally designed as a means for translating liquid flows to low pressure air signals for measurement and control purposes, the unit, combined with a positive displacement meter, converts rpm of the meter into an air pressure signal proportional to the square of the liquid flow. The Transometer can be used for other speed control applications; its initial output pressure signal is adjustable from 0 to 3 psi; the top output pressure signal from 10 to 18 psi. *18.*

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J.I.C. Standards

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- **STEEL TUBE COUPLINGS**
  for ⅛th to 2 inch O.D. tubing
  2 PIECE TITE-SEAL FOR ECONOMY
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  with pressed-on couplings for single and double wire braid hose
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  Straights, Ells and Tees with "Dryseal" pipe threads (N.P.T.F.)
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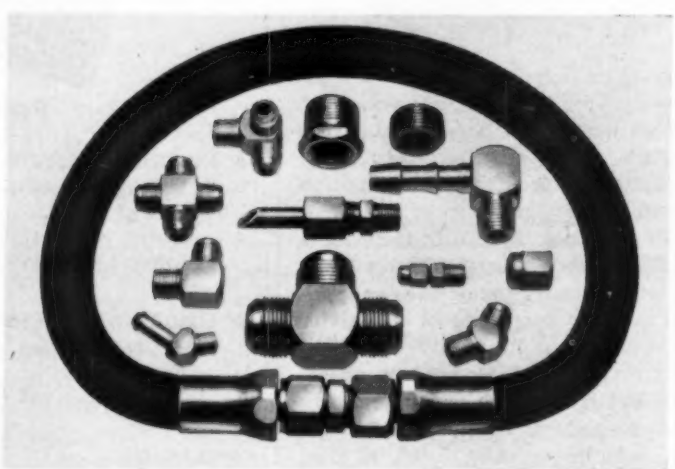
  Let us estimate your preformed tube assembly needs.



• Your installation problems are solicited. Write for catalog and technical data. We also have technical and sales representatives in your area for your convenience. All standard items are shipped from stock the same day your order is received. Excellent service on "Specials".

Hydraulic Accessories

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APPLIED HYDRAULICS DIGEST

Abstracts, summaries and listings of articles on hydraulic and associated applications in industry; reports on prepared papers, talk and discussions pertinent to the hydraulics field.

Oscillating Pilot Controls Valve

W. J. Schupner, *Machine Design*, v 2, August, 1949, pp 124-126.

A detailed description of an oscillating pilot valve to operate a four-way air valve. The operation is by means of an intermediate pneumatic circuit, simplifying the electrical control circuits needed for an unusual solenoid air valve. The solenoids function to control a small volume of air, which serves to actuate the movement of a packless balanced spool. The spool, locked in position by air pressure, requires no holding current. For this reason momentary contact limit switches or pushbuttons may be used, eliminating the need for holding contactors or relays where this type of operation is desired. Drawings show how the spool valve controls porting, details of tiller and valve spool, plan view of pilot unit and cross section of tiller. Details of construction and other design features are given.

Hydrodynamics Of The Hydraulic Torque Converter

Ernst W. Spannhake, *SAE Journal*, v 57, August, 1949, pp 59-66.

A very interesting analysis of the characteristics of the torque converter by utilizing a unit diagram of two widely different type converters and making approximate assumptions to compute velocity relations, vortex value, energy balance and primary torque. The resulting formulas give fairly accurate data on the behavior of a converter type. Diagrams and charts cover essential points developed.

Nitrogen Assembles Pumps Faster

E. M. Voelker, *American Machinist*, v 93, August 11, 1949, pp 118-119.

The superintendent of Tuthill Pump Company outlines the technique used in their shop for the assembly of small shafts into gears and pump rotors by the use of liquid nitrogen cooling equipment. For making expansion fits with liquid nitrogen, shafts or sleeves are cooled to approximately minus 320 F in an insulated bucket, into which the liquid is poured from standard containers. Small parts, such as shafts or bushings, are held in a small basket in the insulated bucket, while large shafts are placed directly into the inner well of

THE NEW OILGEAR "JK"
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To *New* or *Old* Machines

Simply connect a new, small Oilgear "JK" Feed Pump to an Oilgear cylinder and an Oilgear engineered control and you have a complete pushbutton and switch-controlled fluid power system. No hydraulic or electric application engineering is required. Merely follow standard recommendations in mounting units, connect pump to cylinder with two pipes and wire two solenoids on pump to electric controls. Oilgear supplies the feed pump, cylinder, control cams, limit switch panel, control panel and pushbutton station. Oilgear provides patented, tried and proven hydraulic and electric circuits.

You can improve your new and old machines without further congesting your engineering department or employing hard to get qualified hydraulic engineers. You cut production and assembly costs because NO mechanical control linkages . . . NO auxiliary valves, pipes or fittings are required. You do not have to risk delay, disappointment or malfunctioning. You avoid divided responsibility. You receive the full values inherent only in 100% Oilgear systems.

No other single change in a machine can contribute so much to simplified design, reduced costs or improved performance as the installation of the "JK" feed system.

Bulletin 44200 describes this small, compact packaged unit that incorporates feed pump, rapid traverse gear pump, control and relief valves as an integral unit; other features described are: wide range of feeds . . . consistently maintained pre-set feed rates, ease of servicing without disconnecting pipes or draining oil reservoirs, etc. Send for this bulletin today. THE OILGEAR COMPANY, 1564 W. Pierce St., Milwaukee 4, Wis.

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PRESSURE OPERATED SWITCH . . .

★ Compact—Lightweight
★ Proof Pressures—to 150 PSI
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★ Listed for Hazardous Locations
★ Pressure or Vacuum Operation

MODEL No. 440

Durable Model 440 incorporates the explosion-proof Micro Switch. This single pole, double throw switch is Underwriters' Listed for hazardous locations.

Separate housings for pressure and electrical controls permit independent adjustment for pressure or electric systems. Electrical adjustment may be made without reducing the actuating pressure. Pressure adjustment may be made without exposing electrical circuits.

Our competent engineering staff will be pleased to consider your specific engineering problems. Write today!

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MANUFACTURERS OF *George A. Starbird* EQUIPMENT
Dept. A-2, 950 North Highland Ave., Los Angeles 38, Calif.

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Unlimited Possibilities

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Carry a limited number of O-M cylinders (air, hydraulic, water) in inventory . . . yet switch them from job to job with different interchangeable mounts. Blind flange, rod flange, foot, pivot, trunnion, rabbet, clevis and rod eye . . . all are instantly installed on the single basic unit of any specified size without disassembling the basic cylinder. The O-M cylinder is simplified from every angle to save you *space, maintenance* and *original cost.* Write today! A full range from 1½ to 8 inch bores available.

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MACHINE CO., INC.
1204 150th Street, Hammond, Indiana

the bucket. The liquid nitrogen procedure has proven advantageous for the larger shaft-and-rotor assemblies for some sizes of hydraulic pumps because assemblies can be salvaged when shaft or rotor is damaged in assembly or in the field. The previous assembly method consisted of butt welding the shaft to the rotor, and the percentage of rejects was high when the welding operation was not watched carefully. The assemblies can now be salvaged by heating the rotor and pressing the shaft from its bore. The equipment necessary is simple and the speed with which operations can be performed permits the most economical use of the liquid nitrogen, keeping the cost within reasonable limits.

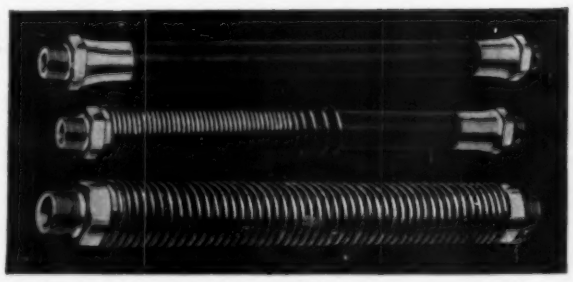
GMC's Hydraulic "V" Drive

Hans O. Schjolin, *SAE Journal,* v 57, September, 1949, pp 52-55.

This article is a digest of the full paper "The 'V' Hydraulic Transmission", presented at the SAE Baltimore Section, Jan. 13, 1949. The article will be published in full in SAE Quarterly Transactions.

Six advantages are listed for the new, fully automatic General Motors "V" hydraulic transmission: (1) excellent performance; (2) nearly 100 percent accessibility of major working parts while the transmission is in the bus; (3) a single fluid system which requires no torque converter seals; (4) reduced weight (about 300 pounds); (5) easy subassembly replacement; and (6) low operating cost. Torque converter speed ratio changes automatically as bus speed changes; direct drive goes in and out at predetermined speeds. The recommended shift speed is 24 mph. The drive gets its

MULCONROY *Hydraulic* HOSE ASSEMBLIES . . .



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Furnished promptly in any length—plain, or with short or continuous outer wire guards—in sizes from ¼" to 2". Made in three styles for requirements ranging from gravity flow to 10,000 lbs. p.s.i. in the ¼" size. Safe, durable, economical, for all types of hydraulically operated equipment. Couplings are brass or malleable iron, sealed-on or replaceable. *Write for new descriptive catalog.*

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MULCONROY COMPANY
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5323 JEFFERSON ST., PHILA. 31, PA.

designation from the arrangement of drive units in relation to the engine mounting. Power is transmitted from the engine through bevel gears to an axis in line with the propeller shaft, the drive units being grouped along this axis.

The transmission assembly is somewhat unconventional and rather simple. There are no external pump, filters or tanks. Bevel gears and clutch are driven by the engine; hydraulic drive is engaged in the clutch and power flows into the converter where speed is reduced and torque multiplied. Drive is transferred through an overrunning clutch into the drive shaft, which is locked to the output flange. Power flow in reverse is the same as for hydraulic drive, except that the reverse gears are engaged, which reverses output flange rotation.

A radial power converter, attached to the rear of the transmission, is a light-weight, self-contained assembly which is easily removed as a complete unit. The converter is a three element type—impeller, rotor and reactor assembly, the latter integral with the back cover of the case. The engine-driven impeller supports the rotor, overrunning clutch and output shaft, assuring excellent alignment and concentricity. The converter does not require its own fluid. The same oil that lubricates the gears and clutch also transmit the drive through the converter. For this reason no torque converter seals are needed. Oil passes the piston rings to lubricate the bearings and clutch.

The net result is a strikingly simple and highly efficient hydraulic power converter. Excellent illustrations, including schematic drawings, show the transmission assembly, the hydraulic drive, power flow in direct drive, the radial power converter, the fluid system, the lubrication system and the accessibility of various units.

Simplified Instrumentation

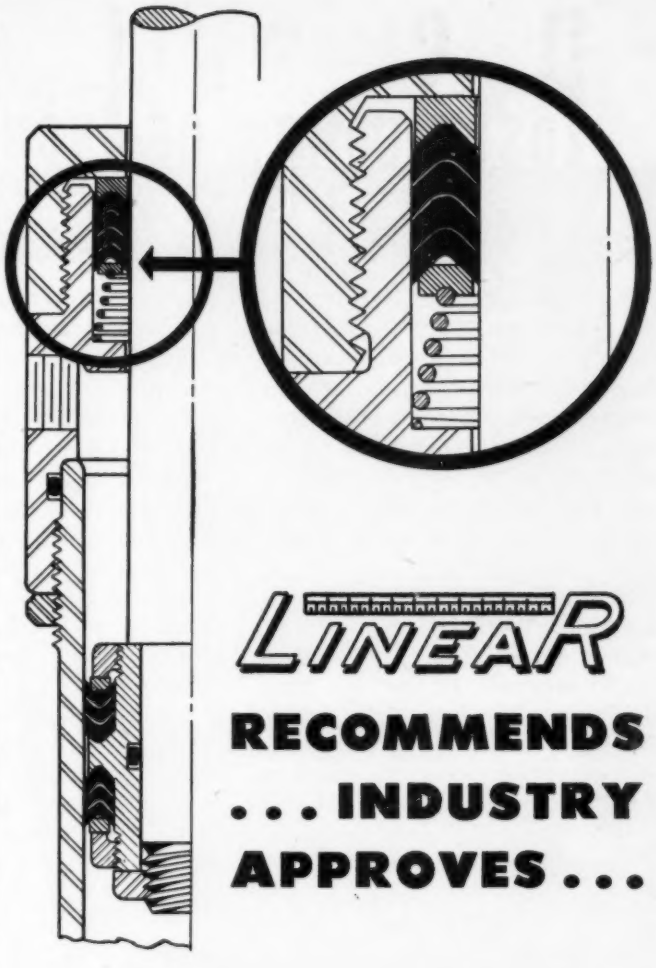
John S. Leslie, *Instruments,* v 22, August, 1949, pp 670-674.

Many features of control principles which are incorporated by various and complex means in air and hydraulic operated automatic controllers or electric and electronic control instruments are also available in simplified form with certain advantages in self-contained regulators of the internal pilot, piston operated type. The basic design of the self-contained internal pilot, piston operated, pressure reducing valve is described in detail, as well as a modification with a second metal diaphragm in lieu of a handwheel for remote adjustment.

The advantages of this type of valve over an air operated controller are listed as: (1) it is less expensive and more compact to install; (2) it uses no air and requires no maintenance of stuffing boxes; and (3) it gives comparable accuracy of regulation and will respond to sudden load changes faster.

A further modification of the basic reducing valve came in with the pump governor, which gave more accurate, dependable control of reciprocating pumps than is possible with any other self-contained governor. Detailed modifications for low, high pressure pump discharges and an automatic reset mechanism

(Continued on page 45)



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RECOMMENDS . . . INDUSTRY APPROVES . . .

Think of it! The many advantages—the resulting lower costs—whenever non-adjustable packing glands are used with LINEAR "V" rings.

1. ***They eliminate*** **over-tightening which causes rapid wear and failure to the packing plus excessively high frictional drag.**
2. ***They eliminate*** **under-tightening which frequently produces unsatisfactory sealing with consequent excessive loss of expensive hydraulic fluid.**

Spring-loading with LINEAR fabric reinforced or homogeneous type "V" rings automatically provides the correct adjustment *built into* the assembly. This makes it impossible for the gland to be over-tightened or under-tightened. Non-adjustable packing glands insure a more uniform break-out friction and lower running friction, assuring longer packing life and consequently, fewer shut-down periods to stop leaks.

Industry needs these cost-saving improvements! And LINEAR offers a complete line of fabric reinforced or homogeneous "V" type packing for *every* service. They operate completely automatically from zero to peak pressures against air, steam, water, gas, oils and solvents over a wide temperature range.

For lowered packing costs—for the best in sealing devices—CALL LINEAR.

"PERFECTLY ENGINEERED PACKINGS"

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POST SCRIPTS OF INDUSTRY

NEWS · VIEWS · TRENDS

John Albright has been named chief engineer of the pump division, Geo. D. Roper Corporation. Albright has been with the company for eight years and will continue in his capacity as consultant on special pump and hydraulic applications. He will supervise all development, design and process engineering for Roper rotary pump products.

Hydro-Line Manufacturing Co. announces the appointment of Hydraulic Service Co., 7550 Mayland St., Philadelphia, Pa., and Mr. Alton J. Fabrey, 227 Fourth St., Scotia, N. Y., as exclusive representatives for the Philadelphia and Western New York territories respectively.

The Tomkins-Johnson Company, Jackson, Mich., was host to 38 sales representatives in August at the company's plant and general office. A "pre-view" of a new line of air cylinders and the hydraulic cylinders, cutters, Rivitors and air controls which will be shown at the National Metal Exposition was given and plans for the fall and winter months were discussed.

Frederick A. Fielder has been appointed general manager of the Bar-Way Co., Stanford, Conn., manufacturers of high pressure, streamline hose couplings.

Process Industries Engineers, Inc., 5941 Baum Blvd., Pittsburgh, has been appointed as sales engineering representative for Gast Manufacturing Corp., Benton Harbor, Michigan. The firm will have exclusive territory for Gast equipment in western Pennsylvania, eastern Ohio and all of West Virginia. R. R. Maccary is president, Wm. W. Calihan and R. E. Nelson, vice presidents, and R. F. Fey, secretary-treasurer of the firm.

J. D. "Jim" Redding has been appointed Executive Director of the Committee on Aeronautics of the Research and Development Board of the National Military Establishment. Redding for eight years was with the Society of Automotive Engineers as manager of the Aeronautical Department. Roy Stoner, who has been assistant to Redding since 1945, will become manager of the SAE Aeronautical Department.

Harold G. Taylor, president, Plastic & Rubber Products, Inc., Dayton, Ohio, announces a $125,000 expansion program to increase the production of "O" ring hydraulic seals. Additions to both the general office and plant, in which the latest type of electrically heated rubber presses is being installed, are expect-

(Continued on page 46)

SNAP-TITE'S
New HYDRAULIC COUPLER

FOR industry, for hydraulically operated farm implements and road building equipment. In fact, wherever there's fluid transmission of power, Snap-Tite offers all the features wanted in a quick disconnect coupler.

QUICK POSITIVE ACTION
Snaps On . . . Snaps Off. Easily operated by hand. Ball Bearing Action.

SELF-SEALING VALVE
Automatic shut-off valve seals when uncoupled. Keeps dirt and foreign bodies out of fluid.

IMMUNE TO FLEXING AND JOLTING
Exclusive swivel action and patented U-Packer maintain positive connection under all conditions.

AUTOMATIC BREAKAWAY
and Spring Clip available for farm and road building applications.

Engineering data on request.

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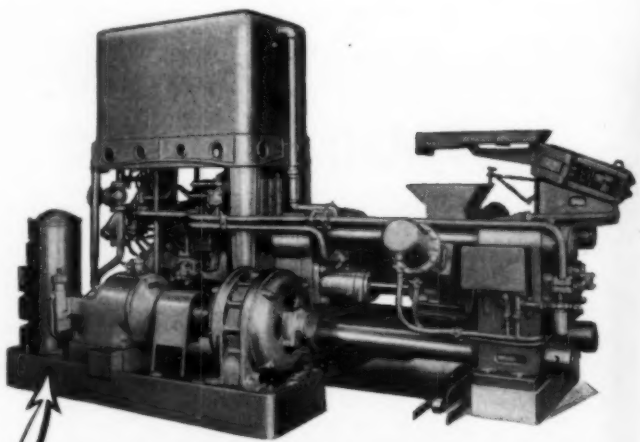

MILWAUKEE FOUNDRY Specifies
Honan-Crane for Hydraulic Oils

On the hydraulic briquetting presses produced by Milwaukee Foundry Equipment Company, Honan-Crane oil purifiers are specified for continuous purification of hydraulic oils.

Complete and satisfactory protection of pumps and precision parts of hydraulic system is assured by continuous purification. Press maintenance and down time due to dirty oil is eliminated.

For full information on low cost purification and maintenance of hydraulic oils, write to Honan-Crane Corp., 102 Wabash Ave., Lebanon, Indiana, subsidiary of Houdaille-Hershey Corporation.

(Continued from page 43)

for turbine driven pumps are diagrammed and described. Two types of the self-contained internal pilot operated regulators for temperature control are also described—one with an internal lever type pilot actuated by a compact liquid-expansion type thermal element, the other a duo-matic control (temperature and pressure). The latter is essentially a pressure reducing valve with the addition of a rugged vapor-pressure thermostatic element which actuates a .016 in thick phosphor-bronze temperature diaphragm to balance the force of the temperature-adjusting spring and the pressure-limit spring.

The design of a simplified control pilot employing an external medium such as air, water or light oil to operate a diaphragm and reposition the main valve rather than use the fluid passing through the valve itself is given with several modifications.

Compressed Air Aids Textile Mills

Anonymous, *Compressed Air Magazine*, v 54, August, 1949, pp 204-205.

A review of a group of new pneumatic devices designed to be used with standard textile mill equipment to improve performance and to increase output. Among the devices described are: an electropneumatic warp spooler for rewinding woolen yarns from small bobbins to one large bobbin or spool; a semi-automatic spool rack, air cylinder operated; an air-operated cut-off winder; and the Lewis air lift or pneumatic table lift, a variable level arrangement for use with cloth-folding machines. Each of the machines are pictured and their operation described.

INDUSTRIAL FILTERS

for **Hydraulic and Lubricating Oils, Paint and Lacquer**

General Full-Flow filters have an exceptionally high rate of flow. Removes foreign particles down to 5 microns. Also valuable in removing moisture. Wool cartridge is cleanable.

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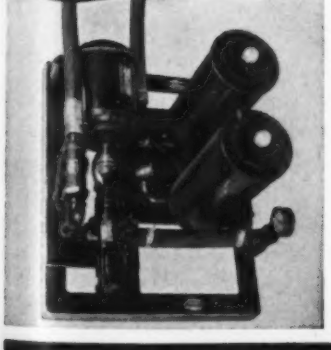

Includes pump for forcing paints, lacquers, or other liquids through the filters. Can be installed anywhere. Uses same Full-Flow filters. When installed on paint or lacquer tanks the result is a much smoother, more beautiful finish.

Write — FOR LITERATURE ... and data on these heavy-duty industrial units.

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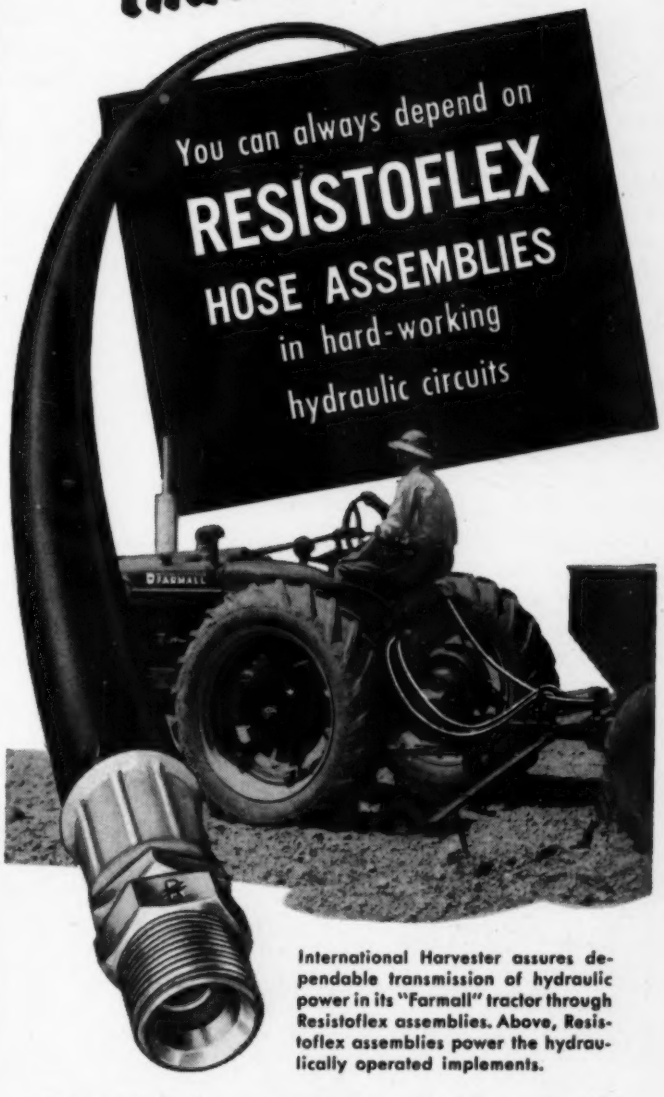

International Harvester assures dependable transmission of hydraulic power in its "Farmall" tractor through Resistoflex assemblies. Above, Resistoflex assemblies power the hydraulically operated implements.

You won't find many applications tougher on flexible hose than a farm implement. Yet, despite the constant movement, vibration and exposure, Resistoflex assemblies don't quit. These top grade lines keep hydraulic circuits functioning at full efficiency—keep a machine on the go. Any time you assure that kind of service, you can take customer satisfaction for granted.

Chances are that Resistoflex lines can do an outstanding job for you, too. Not only are they completely unaffected by flexing and vibration, but they're really impervious to hydraulic fluids and oils too. You run no risk of clogged mechanisms with this non-eroding hose.

Learn more about why Resistoflex lines insure against excessive replacements and service complaints. Write us about your flexible line problem *today*.

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SYNTHETIC FLEXIBLE PRODUCTS AND PARTS FOR INDUSTRY

Licensed to Build Hygroscopic Equipment

J. W. Barker, president, Research Corporation, announces that the Niagar Blower Company has been awarded a license to manufacture dehumidifying and air conditioning equipment under its series of patents covering the removal of moisture from air or other gases by the use of a hygroscopic liquid.

In the process, air is dehumidified by contact with a liquid spray which absorbs the moisture from the air passing through the equipment. As the dehumidifying liquid is diluted, it is automatically re-concentrated in apparatus which evaporates the moisture and discharges it outdoors, providing a continuous process which promises much improvement in the making and handling of many products and materials that pick up undesirable moisture. The process is expected to be suitable for many industrial drying and process air conditioning applications and in preventing moisture damage to electrical and metal products. Comfort air conditioning is likely to be made lower in cost by this new method.

(Continued from page 44)

ed to be completed by December 1. In five years the firm grew from a force of 45 employees with a single sales office to 150 employees with sales offices in eleven leading industrial centers. At the same time, Taylor announced that Robert E. Allen, vice president, who has had charge of the Chicago office for the past four years, has been transferred to the Dayton headquarters.

John E. Livingstone, president of John E. Livingstone Co., hydraulic machinery distributors, announces the removal of their office and warehouse to 16516 James Couzens Highway, Detroit 21, Mich.

Amertool Services, Inc., a corporation formed by 11 companies to supply Latin-American countries with machine tools and associated equipment, has been formed in Cincinnati. Hydraulic Press Manufacturing Co. of Mt. Gilead, Ohio, is a member of this group.

Edward C. Ditzen, formerly chief engineer of the United Engineering Co. of San Francisco and chairman of the Machine Design Division of the ASME, has joined the Rucker Company of Oakland, California as chief engineer. The Rucker Company distributes all types of industrial hydraulic and air power products in the central California area.

Basic Hydraulics, Questions, Chapter 3

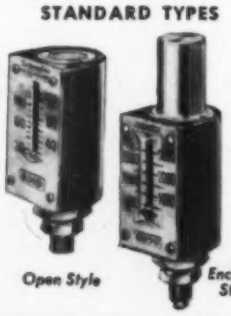
1. Describe the construction and operation of the Bourdon pressure gauge.
2. How can the Bourdon gauge be calibrated?
3. Describe the construction and operation of the Schrader pressure gauge.
4. How can the Schrader gauge be calibrated?
5. What precautions should be taken in the use and care of pressure gauges?
6. What determines the proper size of gauge to use in a hydraulic system?
7. Describe the construction and operation of the Niagara fluid meter.

Everybody says you can't beat
DIRECT-ACTION HYDRAULIC GAUGES
for SHOCK RESISTANCE

And who makes the direct action hydraulic gauges? Schrader, of course! In two styles of vertical scale—Standard Type—and now in the New SCHRADER HYDRODIAL . . . the dial gauge you can read 50 feet away. "Truly a heavy duty unit for hard rugged service." Pressure ranges: For Hydrodial Type—5-50 up to 500-5000 lbs. per sq. in. For Standard Type—5-50 up to 1500-5000 lbs. per sq. in. These gauges are not laboratory gauges, but truly work units that are at their best in surging lines. Write for information about Schrader Direct-Action Gauges.

New Schrader HYDRODIAL TYPE

STANDARD TYPES



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Calibrations Readable at 50 Feet!
Calibration Ranges up to 5000 lbs.
Clear Plastic Face.
Direct Action—Built-in Snubber.

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Division of Scovill Manufacturing Company, Incorporated
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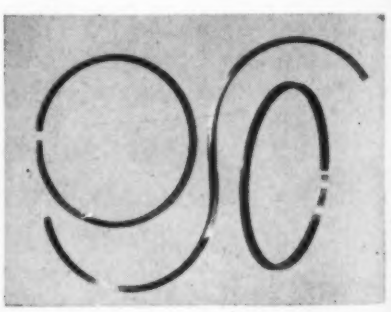
The Long Life "Non-Breakable" Hydraulic Sealing Rings



Three special alloys adopted for hydraulic seals to meet desired requirements. Alloy Bronze, Alloy Steel, Alloy Tempered and Treated Stainless Steel. Our alloys have been proven for almost thirty years to have the longer life and sealing qualities.

All our rings are formed, not cast, tempered and heat treated to obtain the proper resiliency and durability.

They conform to the bore and prevent leakage. They will do the job better, more efficiently and more economically.

Our engineers will gladly cooperate with you on inquiries concerning your particular requirements.

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